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SUPERVISION INSURES TRUCK SERVICE.

Vol. VI Pawtucket, R. I., Jan., 1915. No. 1

THREE GREAT BOSTON SHOW ISSUES

The Business Men, the Owners and the Industrial and Trade Interests in the Territory from Which the Patronage of the Largest and Best Exhibition of the Year Is Drawn, Can Be Reached Through the Editions That Will Be Specialized to Promote This National Exposition.

The MOTOR TRUCK

Show Issue will be mailed March 3.

The AUTOMOBILE JOURNAL

An Owners' Magazine With Its Distribution Concentrated in the East. Show Issue Will Be Mailed February 27.

The Accessary and Garage Journal

Devoted Exclusively to the Motor Vehicle Industry and Allied Trades, Guaranteed to Reach Every Trade Interest. Show Issue Will Be Mailed February 25.

Automobile Journal Publishing Company

Times Building Pawtucket, R. I.

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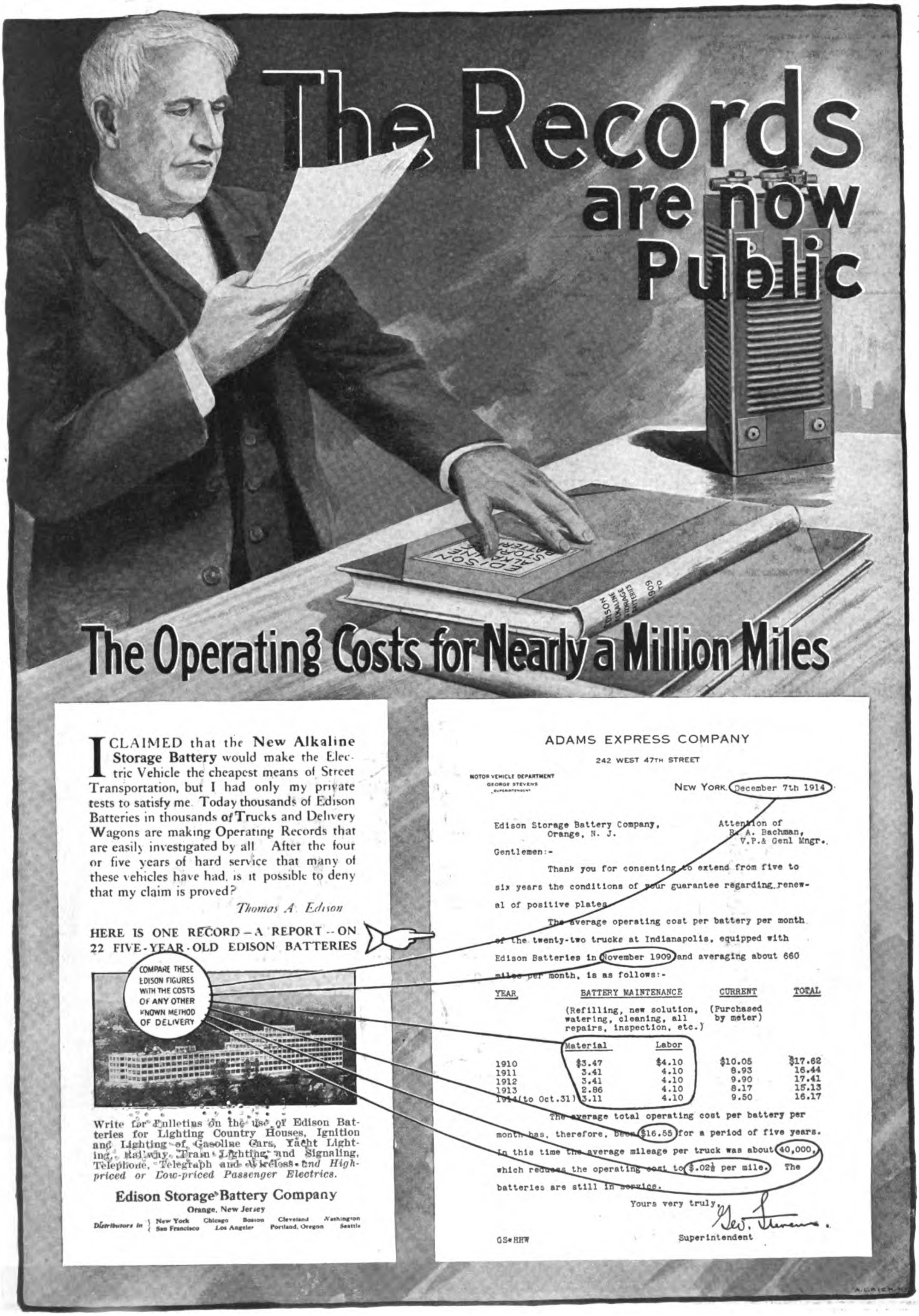

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., JANUARY, 1915 No. 1

AGENT SUPERVISES PEERLESS TRUCK USE.

Beacon Motor Car Company Systematically Examines All New England Machines, Making Recommendation for Maintenance, and Affording "Service" That Means High Economy and Long Vehicle Life If Regarded.

SERVICE as expected by the public of the builders of motor freight vehicles is a very uncertain phrase in that, despite the provisions of the selling contract and the terms of the manufacturer's warranty, purchasers very generally assume that they are entitled to what is constant maintenance, or at least the builder or his representative is responsible for mechanical conditions that result from causes that are wholly beyond their control.

Service is a decidedly ambiguous term. It has never been defined by more than a few of the manufacturers, and generally the responsibilities of these builders are stated in the contracts. Aside from these the owners apparently believe that they can make such use of their property as they please and exact from the manufacturer whatever they demand.

Checker Examining the Equipment of a Peerless Truck Brought to the Service Station of the Beacon Motor Car Company at Boston for an Overhauling.

From the viewpoint of the builder the machines are sold with a warranty of being factory perfect and a guarantee of replacement within 90 days of parts that shall be defective in material or workmanship; that when the vehicles have been delivered the owners ought to care for them precisely as they would any other machinery; that practical results are in ratio to the supervision, the operation, the attention and maintenance of the owners and their employees.

Primarily no man should buy a motor vehicle unless he has use for it and can utilize it to its capacity. This does not mean overloading, faulty operation or lack of care. No machine can be constantly operated in excess of its capacity or neglected, and endure and continue to be efficient and economical. The manufacturer or his agent expects to advise the owner, to assist him in any reasonable way to work his machines to obtain the best results, but they do not expect to make adjustments, provide parts, furnish labor and even supply vehicles in the event of failure or accident unless provided for in the terms of sale.

Purely as a business proposition the manufacturer desires that the owner be satisfied and that the vehicles shall afford extreme service, as well as be efficient and economical of operation. These results are favorable to continuous and increased business, they are dependent upon the uses made of the trucks. The owner must supervise and direct the operation and care and be guided by the experience of the builder, the engineer, and those who have occasion to observe the work performed. A majority of drivers, at least, who are sel-

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INSPECTION REPORT

Firm——— Vehicle No.——— Capacity——— Date———

At——— Customer's No.——— Motor No.———

Motor ———	Springs, Links, Clips, Bolts, Etc.———
Carburetor ———	Brakes ———
Cooling ———	Grease Cups ———
Ignition ———	Axles ———
Governor ———	Lamps and Horn———
Oil System———	Odometer, Mileage———
Steering Gear———	Radius Rods———
Clutch ———	Wheels ———
Trans. Gears, Shafts, Sprockets, Chains, Etc.———	Body ———

TIRES

Make	Type	Size	Miles	General Condition, Etc.
FR				
FL				
RR				
RL				

SEE OTHER SIDE FOR REMARKS

Monthly Inspection Report Blank, Printed in Black on Yellow Paper, 11 Inches Length and 8⅝ Inches Width.

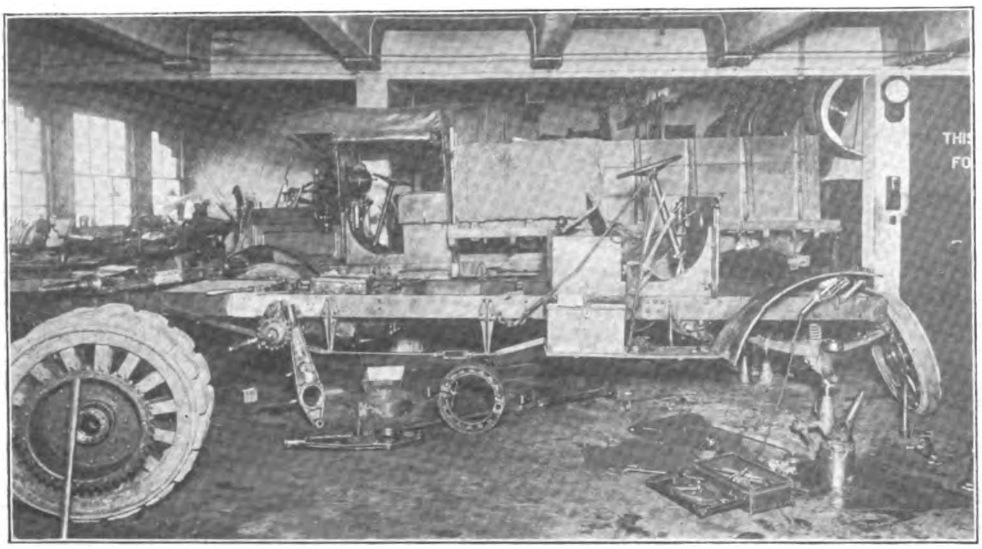
dom mechanics with tools, whose experience is rarely constructional, whose knowledge is not based on engineering principles, are permitted to experiment with and neglect machines that represent substantial investments, and oftentimes their judgment is accepted as against the men who are experts.

Owners will compel haulage of overloads and will not allow the drivers time to work on their machines. They can excuse their own absence of judgment and neglect, but will condemn vehicles which would be productive if used rationally. The well established manufacturers or their agents will systematically and thoroughly assist the owners to efficiently operate their trucks. They will co-operate with them to an extent that is seldom understood, and this means mechanical and operating supervision which, if heeded, will at least permit practically continuous use and afford a prolonged service life.

Service Station for Peerless Trucks.

The Beacon Motor Car Company, Boston, Mass., is agent for the Peerless Motor Car Company, Cleveland, O., builder of Peerless trucks and pleasure cars, and it maintains for the benefit of owners of Peerless machines a service department that is extremely well organized. The company has at its service station, at 660 Beacon street, every facility for repair and restoration work. The company trains the drivers to have a good operating knowledge of the vehicles, and after the trucks are delivered exercises an oversight that places in the possession of the owner once a month a report of the condition of them mechanically.

The Peerless Company's warranty is for 90 days and guarantees replacement of parts if necessary from defective material or faulty workmanship, this being the standard warranty of the National Automobile Chamber of Commerce. In addition the Beacon Motor Car Company makes warranty that it will for 30 days make all adjustments free of charge if not the result of misuse or accident; that it will for 90 days replace and install broken parts caused by defects in material, and for a period of one year guarantee to replace, but not install, broken parts caused by defects in material, a charge being made for all work done outside of the company's service station.



Chassis of a Peerless Truck Being Overhauled, After 18 Months' Service, at the Repair Shop of the Service Station.

When a truck is sold the purchaser is informed that the man who is to drive the machine may be trained in the service station for any period desired, or until in the judgment of the superintendent he is competent to do the work. He is not paid by the company for this training, and he is required to conform to the shop rules as to hours, working regularly from 8 to 12 and from 1 to 6 o'clock. What he knows concerning motor vehicles is learned by the superintendent, who decides what instruction the man shall receive. If he knows nothing of automobiles

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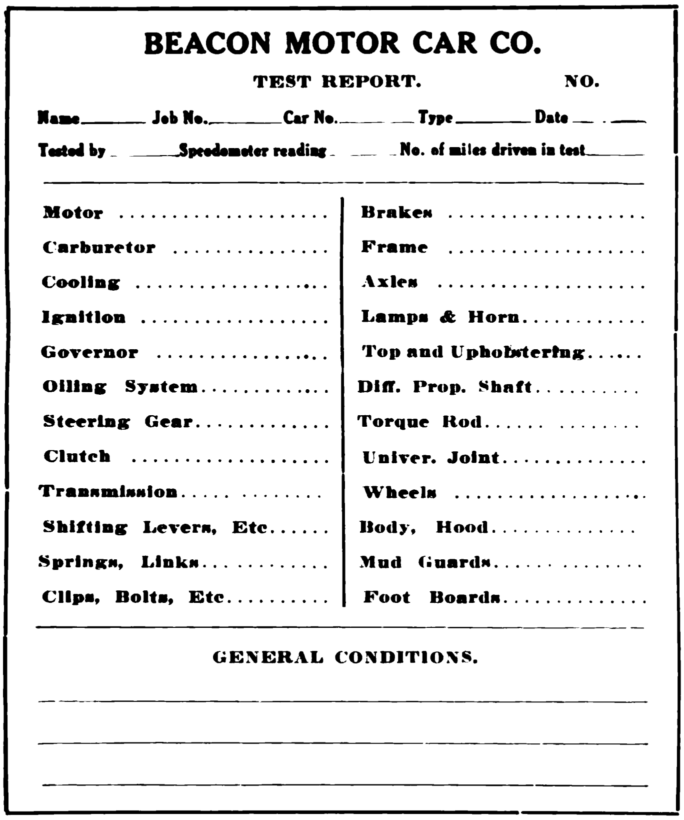


BEACON MOTOR CAR CO.

TEST REPORT. NO.

Name_____ Job No._____ Car No._____ Type_____ Date_____

Tested by _____ Speedometer reading _____ No. of miles driven in test _____

Motor	Brakes ....
Carburetor	Frame ....
Cooling	Axles ....
Ignition	Lamps & Horn ....
Governor	Top and Upholstering ....
Oiling System	Diff. Prop. Shaft ....
Steering Gear	Torque Rod ....
Clutch	Univer. Joint ....
Transmission	Wheels ....
Shifting Levers, Etc	Body, Hood ....
Springs, Links	Mud Guards ....
Clips, Bolts, Etc	Foot Boards ....

GENERAL CONDITIONS.

Report of Tester Blank, Printed in Black on White Paper, Red and Blue Ruling, 12 Inches Length and 8⅝ Inches Width.

he is set at work in the repair shop of the service department as the helper of a first class mechanic, who explains thoroughly every job he is on—the function of any part, group or assemblage, what its condition ought to be, the causes of the condition it is found in, the means for restoration, and what expedient might be resorted to in an emergency.

The purpose is not to teach him to be a mechanic in handling tools and working metal, but to give him a good foundation of practical knowledge of machinery functions, what adjustments can be made, what conditions can be obviated by care and attention, and what work is necessary to insure efficient operation. He continues this work until the superintendent believes he can be taught driving (the assumption being that the owner is willing to pay the man wages, or the man can give his time to learn his work). If the man has had experience driving pleasure cars he is set at work in the shop for a week or more, where he obtains a good insight into the mechanical construction of the machines.

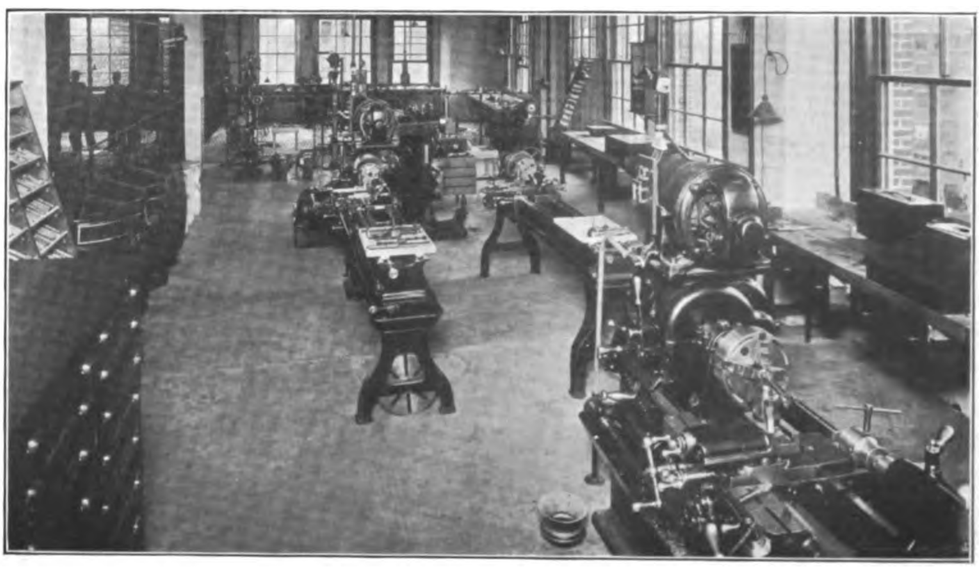
Have Advice of Expert Men.

The driving is taught by work on the company's demonstrating trucks, where the men learn to drive, to load, to oil and grease the machines, and to give systematic attention. The first morning the demonstrating driver oils and greases the truck, beginning at the right front spring and ending at the left front spring, making a tour of the machine and oiling, greasing and filling the water, oil and fuel tanks. The next day the pupil does this work, following a formula each day that nothing may be neglected. The man is taught how to drive in all conditions of operating, and to be safe and certain of what he does. This period of tuition is continued until the man is regarded competent by the demonstrating driver and the superintendent to handle the machine wherever it shall be used.

When the truck has been delivered and the driver has received his license, the company sends an expert driver, who works on the truck for 54 hours, either six nine-hour days, or otherwise divided to convenience the owner, there being no expense for this man's service unless the truck is used outside of greater Boston, when his transportation and hotel bill is charged. This man coaches the driver during the period, learns what work is to be done with the truck, the conditions of operation, the loads carried, distance driven, loading and unloading facilities, how the truck is to be garaged, and what provision has been made to insure care and attention. If the driver is not trained at the Peerless station he is given the same course of training that the men who work with the demonstrating truck receive. The purpose is to accomplish all that is possible in the 54 hours period to which the expert driver is assigned. Should the owner desire the training continued he bears the expense of the expert's services. The company's driver makes report as to the conditions, and when his reports indicate the need the owner is given suggestions and recommendations are made that will afford him better or more economical results.

Experience of the Men Is Valuable.

The observations of the company's driver in the case in point are directed in any way that will benefit



The Machine Shop of the Service Station, Which Has Facilities to Do Any Work in Truck Maintenance Save the Production of Some of the Large Units.

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BEACON MOTOR CAR CO.

Job No............Car No............Date............

Name ....

Address ....Mileage............

Detail Instructions	Charge

THE WORK CALLED FOR ON THIS REPAIR JOB AS FAR AS I CAN SEE HAS BEEN COMPLETED AND IS SATISFACTORY.

....OWNER

PER ....

Work Order Blank, Filled from Tester's Report, Printed in Blue on Manila Card, 12 Inches Length and 6 Inches Width.

the owner, for while they primarily have to do with driving, the practical experience and knowledge of the man are valuable and his estimate of conditions and methods of usage is carefully made with no other purpose than advising the owner how the greatest efficiency and economy of the truck may be, in his judgment, best obtained.

When the owner begins the operation of the truck he is expected to utilize it to meet his own purposes, and yet to protect his own interests. Overloading that is definitely known to the company, according to the original sales guarantee, terminates the manufacturer's warranty. Overloads are advised against, but cannot be prevented save by the owner. Good care is always recommended, but the owner is the only one who can insure this. The supposition may be that the owner does not know just how his machine is being operated—that he cannot always control the driver.

The company's system of inspection provides for accurate knowledge that must receive the attention of the owner if he is interested in his own property. The company's service superintendent prepares an inspection schedule for Greater Boston that requires an examination of a machine or several machines each day. The inspector finds these trucks in operation wherever he can, rides with the drivers, goes over the machines carefully, notes the conditions as regards adjustment, cleanliness, lubrication, wear, the loads carried, the efficiency, the work of the men in charge of them, and learns the manner of garaging and the degree of attention.

BEACON MOTOR CAR CO.

TIME CARD

Name.............. ....No.......Date..........

Job. No.	Description of Work	Hours

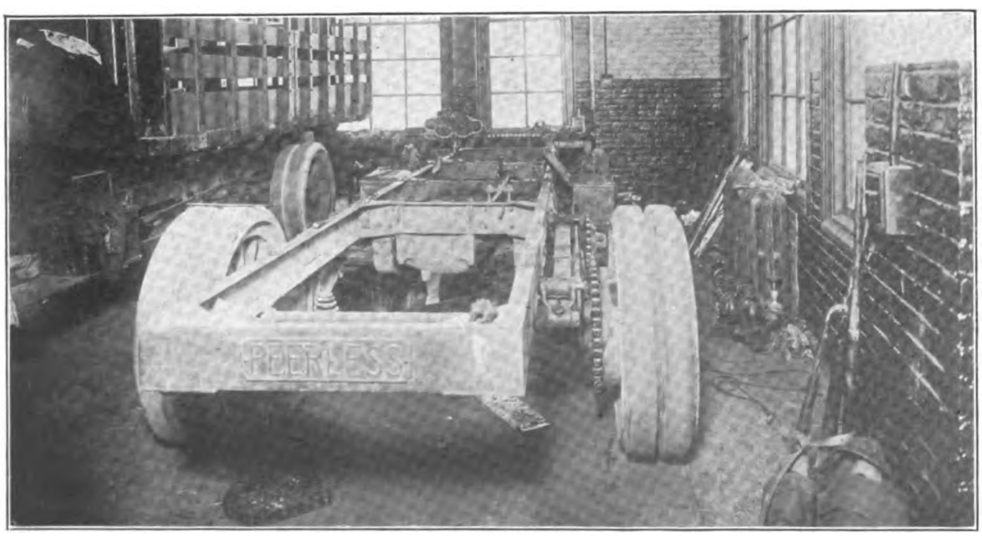
Time Cards Must Be Deposited In Box Each Night. Approved,

Use this card for one job only, always state time on each part.

....
Foreman.

Time Card for Workmen, Printed in Black on White Paper, 4½ Inches Length and 6½ Inches Width.

Reports of these inspections are made, together with any observations for the information of the service superintendent, so that the company will have a full statement of the use made of the truck and how it is cared for. A copy of the report of each inspection is sent to each owner, and it being specific in its recommendations with reference to components, etc., and frequently including a suggestion which will mean more satisfactory use or greater economy, he is in possession of the same information on file with the company. When the service superintendent believes best to do so he sends a letter to an owner directing his attention to conditions shown by the inspections.



Peerless Truck Chassis in the Service Station Garage for an Overhaul by the Driver, Helper and a Skilled Shop Workman.

Strange as the statement may appear, some owners are inclined to regard the reports as being prejudicial to their in-

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TRUCK INSPECTION REPORT

Form 138

Submit One Inspection Report for Each Car Inspected.
If More Than One Day Is Consumed Submit Supplementary Report for Each Day.

Owner	Date ....
Town	Car Number ....
State	Owner's Number ....
Business	Mileage ....

Motor Compression	Propeller Shaft ....
....	Transmission Gears ....
Motor Hanger Bolts	Shifter Rods ....
" " Frame Bolts	Bearing Housings Loose? ....
Cylinder Stud Nuts	Bearings Loose? ....
Crank Case Bolts	Stuffing Boxes Tight? ....
Valve Mechanism	Sprockets ....
....	Oil in Transmission Case ....
Fan Belt	Chains Tight ....
Fan Bushings	Chains Well Oiled ....
Carburetor	Service Brake Drums Tight ....
Control Rods	Service Brake Adjustment ....
Gasoline Line	Emergency Brake Adjustment ....
Governor	Ratchet, Pawls, Etc ....
Magneto	Brake Lubrication ....
Magneto Coupling	Springs Front ....
Magneto Lubrication	" Clips ....
Loose Wire Connections	" Bolts ....
Control Rods	" Shackle Links ....
Water Pump	" Clamping Bolts ....
Radiator	" Grease Cups ....
Water Connections	Dumper Springs Front ....
Water Jackets	Springs Rear ....
Carburetor Water Line	" Clips ....
Oil Pump	" Bolts ....
Oil Lines	" Shackle Links ....
Sight Feed	" Clamping Bolts ....
Crank Case Oil Level	" Grease Cups ....
Time Gear Case Oiling	Bumper Springs Rear ....
Clutch	Rear Axle Alignment ....
....	Radius Rods ....
Shifter Collar	Rad. Rod Lubrication ....
Clutch Lubrication	Wheels ....
Steering Gear	....
Steering Column Loose	Wheels Loose on Bearings ....
Lost Motion in Control Head	....
Steer. Column Brkt. Loose	Lamps ....
" Cross Rod	Speedometer ....
" Side Rod	Horn ....
" Swivel	Fenders ....
" Sector Arm	Running Boards ....
" Knuckles	Tool and Battery Box ....
" Knuckle Arms	Seat ....
" Bushings Worn	Top ....
Front Wheel Alignment	Body ....
Lubrication of Steer. Conn.	Power Hoist ....
Sod Pan	Adjustment of Trips ....
....	Mitre Gear and Brkt. Bushings ....
Muffler	Power Hoist Lubrication ....

TIRES

	Make	Type	Size	Mileage	Condition
F R					
F L					
R R					
R L					

Annual Inspection Report, Printed in Black on Yellow Paper, 13 Inches Length and 8⅝ Inches Width.

GENERAL

What Suggestions or Recommendations Regarding Repairs Did You Make to Owner?

....
....
....
....

Condition of Truck in General (Dirty or Well Oiled, Etc.) ....
Is Chauffeur W. or B.? ....
Ability of Chauffeur as Driver ....
Ability Chauffeur as Mechanic ....
Character and Temperament of Chauffeur ....
How Much Time Does He Have for Upkeeps? ....
Attitude Owner Toward Dealer ....
Attitude Owner Toward Truck ....
Attitude Chauffeur Toward Truck ....
In Market for New Truck? ....
If So, Give Details ....

WORK PERFORMED—Miscellaneous Remarks

....
....
....
....
....
....
....
....
....
....
....
....
....
....

Time Spent .... Hours

Signed ....

Inspector.

Reverse of Annual Inspection Report, This Being a Summary of the Service Conditions as Well.

terests—that is, criticism of their judgment and supervision, or perhaps interference with their right to use their property as they please. Others, however, believe the reports are made for their benefit and they accept the recommendations and act upon them. Some owners, having received reports that criticise the drivers, show them to substantiate their claims of neglect or incompetency, and the men operating the trucks sometimes place obstacles in the way of the inspector with the hope of preventing similar information reaching their employers. Such incidents sometimes necessitate the company informing the owner just what might result were there continued tolerance of ignorance or carelessness.

The reports are carefully filed and each month these are compared with previous reports to ascertain whether the owners have given attention to the information sent them; if they have sought to profit by the examinations of the machines and the suggestions made for their benefit. The comparisons often show that the owners do not give the supervision or the thought to their trucks that the investments justify, and that they will seemingly intentionally neglect conditions that ought to be improved or materially changed.

Two facts may be noted, that the owners will neg-

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OVERTIME PASS.

Name.....................*No.*......*Date*..... *191*
to work on Job No................
Work done...
....
....
Commenced at...............*A. M.*............. *P. M.*
Finished work at............*A. M.*.............*P. M.*
....
Foreman.

Overtime Pass, Printed in Black on Red Paper, 4½ Inches Length and 6¼ Inches Width.

lect needed repairs because of a desire to "economize" in maintenance expense, or because of an unwillingness to send the machine into the garage or service station for repairs, and that the owners will not give the drivers time to do work. If a man, for instance, reaches a shop or store at 5 o'clock, instead of giving him the remainder of the day to work on his machine, probably less than an hour of time that he can be expected to give as a day's service, he is sent out with another load that will keep him out until 7 or later. The driver, having worked overtime, cannot be expected to give attention to the truck without extra pay, and he becomes indifferent, although perhaps a careful man, well qualified to do mechanical work and keep the machine in operation if he were encouraged.

Some owners depend entirely upon the drivers to do the mechanical work with the tools they have available, sending the trucks into the station when repairs are of a character they cannot undertake. Others, having a sufficient number of machines, employ mechanics to keep them operative, perhaps having overhauls only done at the service station. Results are in ratio to the capacity of the men, the time they have for the work, and the disposition of the owners to maintain the vehicles.

The inspections in the New England territory outside of Greater Boston are made according to a schedule arranged for this work by President John L. Snow, the inspectors usually combining examinations of both pleasure and service machines. These reports are handled in the same manner. Owners at a distance do not usually depend upon the service station, but upon the service it can give them. The Beacon Motor Car Company has practically all of New England as its sales territory, and in some localities it has sub-agents. Inspection may be made through these agencies, in which event the monthly reports go to the sub-agent, but from all other sections they are returned to the superintendent of service, as are the annual reports. In the use of the trucks the conditions stated in the warranty of the company are observed with reference to adjustment, replacements and repairs, and statement may be made that if the recommendations of the inspectors are observed the operating expense will be minimum and the efficiency high. Careful maintenance means making adjustments whenever found necessary, and so far as possible preventing wear; insuring sufficient lubrication and fuel economy. Comparison of the reports by the service superintendent is productive of much valuable information, and facts developed that are deemed to be of sufficient consequence are always made known to the owner.

BEACON MOTOR CAR COMPANY
Requisition on Stock Department
Charge Repair Department

Job No.............................
Please deliver

Filled by	No. Pieces	Part No.	Model	NAME		

Workman ______________ *No.*________
*By*______________

Stock Room Requisition, Printed in Black on Yellow Paper, 4⅝ Inches Length and 9 Inches Width.

Comment can be made of the disregard for or ignorance of the value of mileage records. The odometers or other indicators are often useless because of failure or damage and the accurate knowledge of the fuel consumption, tire wear, chain service and endurance of repairs, is not obtainable. Not only this, lubrication is recommended by a carefully developed chart of the chassis, on a basis of miles driven, and without the mileage record lubricating cannot be carefully or systematically done. The statement is made by the superintendent of service that if the owners of machines could understand the possibilities of personal supervision of their equipment, even for a brief period once a week, and have regard for recommendations made solely for their benefit, the vehicles would be much more serviceable and could be operated with decidedly greater economy and satisfaction.

The company's desire is to have the owner's co-operation in what is done to make the machines useful and efficient,

Peerless Motor Car Company of New England
Return Requisition on Stock Department
Credit Repair Department

Job No...........................
Please credit

Filled by	No. Pieces	Part No.	Model	NAME		
				CREDIT		

*Workman*______________ *No.*________
*By*______________

Stock Return Requisition, Printed in Black on Pink Paper, 4⅝ Inches Length and 9 Inches Width.

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and to have them understand that the real result is to insure the rational operation of the machines, yet there are those who appear to believe that the supervision and reports are intended to limit the uses that may be made of the vehicles. For the benefit of the owners the company has spare wheels, radiators and ignition batteries, which are rented so that a truck need not be withdrawn from work for more than a very brief period for the making of a repair to a radiator or a wheel. For radiators the charge is 50 cents daily, the charge being made from the day following delivery or shipment from, and until the day previous to return to, the service station. For wheels, including the use of the tires, the charge for front wheels is $1.25 for three and four-ton trucks and $1.50 for five and six-ton trucks, and for rear wheels $2.50 and $3 for the respective capacities stated. Damage from fire or accident is charged in addition to the daily rate.

Service Station Facilities.

The truck service department is maintained jointly with that for pleasure cars in the big station of the company in Boston. The equipment is exceedingly complete, so that any work can be done, and there is a stock room in which parts of all kinds for both cars and trucks are instantly available. At the station all the adjustments required by the guarantee that are not made by the inspectors are made, and all restoration or replacement work is done. Here the owners can have done whatever work is desired, most of them sending the machines in for overhauling. Anything, from rebuilding to a trifling replacement, is undertaken, either on the basis of stock and labor or an estimate, but no estimated price is fixed until careful examination and accurate knowledge of the condition of the machine is obtained.

When a machine is brought into the station it is examined by a checker, who notes the equipment throughout, and the machine must be sent out with the same equipment unless some has been replaced, of which there must be record. This done, the truck is carefully examined by a tester, who gives it both floor and road tests. This report is explicit and with reference to every detail, complete efficiency being sought. The recommendations of this report are approved by the superintendent and then the work order is made, there being 16 copies, including the heavy manila tag that is attached to the chassis. These copies are for the owner, the general foreman, the general repair department, the accounting department, the checker, the garage, the stock room, the tool room, the machine, blacksmith, tinsmith, wood working, paint, upholstery and electrical shops, and each constitutes an order for the particular work that may be required of the shops, and is the record necessary in handling the job.

How the Work Is Handled.

The orders come through the superintendent, the general foreman, the assistant foreman in charge of the departments, and work may be done simultaneously in several shops. The charge may be to the owner, to the company or to the factory, this being designated on the work orders. The work is given a job number, which is continued in every department. The workmen charge their time to the job for each day, giving a description of the work and the hours or minutes worked, the time cards being approved by the foremen. One card is used for each job, the time on each part being stated. These cards are deposited each night. Overtime work is recorded on an "overtime pass", which states the number of the job, nature of the work and the time.

When stock is required the workman makes requisition on the stock room, giving the number of the job and the stock needed, and when this is approved by the foreman the stock is issued. On this the cost price and the price charged is entered against each item. In the event of stock being requisitioned that is not necessary or cannot be used, a return requisition is issued by the foreman against the job, and the job is credited in the stock room and the stock record is debited with the stock returned. These cards and requisitions are collected each day and those for each job are kept in a folio, so when the job is completed there is a complete record for each day and for the entire work. From these the accounting department makes up the total bill. As the work of the different departments is completed the work order tag on the chassis is punched by the foremen of the different shops, and when the truck is fully restored it is sent to the garage, where it is tested and the results of each work checked by the tester.

Not until the machine has been passed as in condition for delivery does the work record terminate, and when it is sent out it is checked for equipment. But before it is turned over to the owner or his representative the work order tag is stamped and a signature is required to a printed statement that so far as can be seen the work called for on the job has been completed and is satisfactory. The work done is to a high standard, by thoroughly capable and experienced men, and the charges are as moderate as is consistent with such work. The illustrations show the excellence of the equipment and the facilities for work of all kinds, and evidence the character of the "service" that is maintained for the benefit of owners of Peerless trucks and cars. If the machines are not mechanically efficient and enduring the owners must assume responsibility, for they have available the resources of the company's station and its co-operation to learn the condition of the vehicles, and if they reject this information they do so with a thorough knowledge of its value to them.

The Montreal, P. Q., auto show, which will be held this year from Jan. 23 to 30, 1915, will, instead of devoting a separate week to commercial vehicles, set apart for them a space in connection with the pleasure car exhibits. The exposition will be held in the Allen line, Liverpool, buildings, and will provide 60,000 square feet of space for exhibits.

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S. A. E. ELECTS VANDERVOORT PRESIDENT.

W. H. VanDervoort, President of the S. A. E. for 1915.

FURTHER standardization was the principal work before the mid-winter meeting of the Society of Automobile Engineers, held at New York City, Jan. 5-7, the organization having to deal with an unusual number of recommendations by the standards committee, and, of course, the election of officers to serve for the year to come.

The attendance was very small as compared with previous meetings, and this was the occasion of comment as to the wisdom of having the annual gathering during the New York automobile show. Various causes contributed to prevent members attending—the condition of business, show activities, pressure of factory work, etc., and a possibility is that some other time for the winter meeting will be decided on, but this is a subject for future consideration.

The meetings of the standards committee, the governing committee of the sections and the council took place the first day of the session, these disposing of all matters before them in preparation for the annual business meeting, which required a considerable part of the morning of the second day. At this the tellers reported the result of the election, which was with the choice of W. H. VanDervoort, president of the Moline Automobile Company, Moline, Ill., as president; F. H. Hutton, first vice president; J. A. Anglada, second vice president; A. B. Cumner, treasurer; C. B. Rose, Velie Motor Vehicle Company, Moline, Ill.; John Wilkinson, H. H. Franklin Manufacturing Company, Syracuse, N. Y.; William P. Kennedy and F. M. Germane, Standard Roller Bearing Company, Philadelphia, Penn., councillors.

Secretary Coker F. Clarkson read the report of the treasurer, which showed an excess of $5505.26 of receipts over expenditures as of Dec. 1, 1914, and since the previous meeting 32 members, 23 associate members, six junior members, one affiliate member, five affiliate representatives and 11 student members had been enrolled by the association. The society was represented as having the greatest strength in its history. Henry M. Leland, the retiring president, and President VanDervoort made addresses, the former dealing with the work of the association and the future of automobile engineering, and the latter emphasized the problems of motor vehicle engineers, stating that designing, although seemingly well established, had only been begun. He referred to the great reductions in manufacturing cost and the separation of automobile engineering into two divisions, designing and production, the former to create and the latter to maintain high quality despite price reductions, or to improve qualities at no increased expense.

One event of especial interest was the presentation of a handsome silver piece to Henry Souther, chairman of the standards committee, and to whom is due in no small measure the progress made by the society in standardization, who, because of pressure of other duties, had retired from the chairmanship after four years' service. Mr. Souther was also honored by election to life membership in the society.

The standards committee at its meeting heard reports from its divisions covering the following: Electrical equipment—fittings for single-wire system, dimensions of bulb bases, sockets and connector plugs, lamp bracket dimensions, junction boxes and definition of headlight glare; iron and steel—physical properties of steels; frame sections—fourth report; lock washers—specification of lock washer material; carburetor fittings—method of bolting of flanges of side-outlet carburetors, extension of S. A. E. flared tube unions to 5/8 and 3/4-inch sizes and tolerance for union nut bore; miscellaneous—air pump dimensions, rod and yoke end pins, extension of thread standard beyond 1 1/2 inches diameter, cotter pin standardization, width of flat belts for motor fans and hose clamp sizes; ball and roller bearings—stock sizes of taper roller bearings and thrust bearings; research—vehicle taxation formula; electric vehicle—motor characteristics and voltages, standardization of name plates, insulation of controllers, number of cells in standard battery equipment, wiring sizes, insulation, charging receptacles, fuses, polarity of battery terminals, lamps and efficiency tests of solid rubber tires; standards exchange—bell housings, motor support dimensions and piston ring groove dimensions; springs—fourth report.

The carburetor fittings division's report, recommending the adoption of the existing standard dimensions and contour, with the bolts placed in a vertical plane, for carburetors of the side-outlet type, this being to eliminate the confusion existing with carburetors suited for use with block motors, was adopted. Similar action was taken with the report of the same committee relative to an increase of tolerance from .002 to .005 for all sizes of union nut bore, and that the sizes of flared tube union fittings be increased by the addition of 5/8 and 3/4-inch sizes.

The pleasure car wheels division's report was to the effect that the recommendation made at the previous meeting, that nine tire and rim sizes be manu-

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factured and used as regular equipment, had been accepted by the Clincher Automobile Tire Manufacturers' Association, and the recommendation was adopted. This provides for nine over-size tires, these to be used by owners who desire to increase the size of equipment.

The report of the miscellaneous division on standard pins for yoke and rod ends, generally used for brake and steering rod linkage, was adopted.

The report of the iron and steel division, dealing with the physical properties of these metals, this being supplemental data to the chemical specifications, suggesting special uses for various steels and practise for determinations for heat treatment and machining, was adopted.

The fourth report of the springs division concerned nomenclature of cantilever springs and recommended three types for specific designation, as well as a standard test for parallelism of eyes and master leaf, limits for spring end finishing, and dimensions of frame brackets, centre bolt offsets, spring clip nuts, centre bolts and spring widths. This report was adopted.

The report of the electric vehicle division was accepted as recommended practise, but was not adopted as standard practise. It included the suggestions that electric vehicle speed ratings be based on continuous operation with half load on hard, smooth and level roads or paving at the actual average battery voltage; that electric vehicle mileage ratings be based on the rated five-hour discharge capacity of the battery and a continuous run over the character of surfaces previously stated; that two classes of motors be used, of 80-85 volts and 60-66 volts, characteristic curves of each of the voltages of either class to be furnished by the manufacturer; that each motor carry a name plate giving the name and address of the manufacturer, whether series, shunt or compound wound, frame size, volts, amperes and revolutions a minute, with minimum and maximum limits for the last three; the use of the rebound test for solid rubber tires; that the number of lead-acid cells to a standard battery be 42, and that 60 Edison cells constitute a battery. The frames section division also made recommendation of practise with reference to the radii of curvature at the frame ends and the drop of the frames.

Reports that were progressive were made for the ball and roller bearing division, the standards exchange division, the commercial car wheels division, the lock washers division, the electrical equipment division and the research division. The research division has engaged in investigation of a formula for the determination of the relative wear of vehicles on highways, this to be used as the basis of recommendation for vehicle taxation.

The result of the mail inquiry as to the place and time for the summer meeting indicated a decided preference for a session on a steamer on the Great Lakes in June. The statement is made that this would probably be as satisfactory and economical choice as could be made. In the event that financial encouragement is given there will probably be exhibition of testing apparatus made by the society in connection with the congress of engineers at the Panama-Pacific Exposition at San Francisco, but this has not been determined. During the meeting a total of 313 members were registered and the largest number attending any one session was about 60.

PULCHER IS PRESIDENT.

Head of Federal Truck Company Executive of Detroit Automobile Club.

Martin L. Pulcher, vice president and general manager of the Federal Motor Truck Company, Detroit, Mich., is now president of the Wolverine Automobile Club of that city, which is the largest organization of the kind in Michigan and one of the best known and most influential bodies in America.

The officers of the club are chosen by the board of directors, which board is elected by the members, and in naming the organization for the present year, Mr. Pulcher was the unanimous choice of the board. Mr. Pulcher has been extremely active in the affairs of the club since its organization six years ago, and through much committee membership has more intimate knowledge of its affairs than any other man.


Martin L. Pulcher, President Wolverine Automobile Club, Detroit.

The club has a membership of more than 1000, its club house in Woodward avenue is one of the best appointed in Detroit, and it is especially active in constructive and philanthropic work. One of its endeavors has been the development of the streets of Detroit and the highways of Wayne county, and the improvement of the roads of that section, which are a material benefit to every interest, is the direct result of the systematic campaign that the club has maintained for betterment of the public ways. The club has consistently sought to formulate legislation that would be beneficial to the motorists and protective of the public as a whole, and in addition has brought about uniform information and convenience for the users of the highways. Under the administration of President Pulcher an even more vigorous progression is promised. The activities for the coming year will be largely directed toward the development of the main highways in Wayne county, which are being very generally constructed of concrete.

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ELECTRIC MEN TO MEET.

Two-Day Convention at Boston During the Big Motor Vehicle Show.

A two-day meeting of central station and electrical vehicle interests will be held at Boston March 9 and 10 at the new home of the Boston City Club, which will be an innovation in numerous respects. The intention is to have the convention interest and attract a large number, without a large expenditure of money for entertainment, printing of papers, expenses of speakers, banquets and what are generally regarded as necessary features in connection with gatherings of this character.

The intention is to have the meeting without written or printed papers, there will be no official stenographer, and a banquet has been given over. The gathering will interest because there will be full and complete consideration of the subjects, which will be named from a question box, and so far as possible the first day will be devoted to central station problems. The second day electric vehicles and the relations of the electric and central stations will receive attention, and the evening of the second day will be taken up, in all probability, by general discussion of traffic problems, transportation efficiency, parking facilities, etc., as applied to Greater Boston, but with a view of suggesting principles that will be applicable in other sections of the country.

The desire of the officials of the New England section of the National Electric Light Association, which has assumed the responsibility of projecting and organizing the meeting, is to stimulate enthusiasm in the use of electric vehicles for both freight and passenger transportation, and as the meetings will take place during the Boston automobile show, which will serve to draw many thousands to the commercial centre of New England, there is every reason to anticipate a large attendance.

The sessions will take place at the magnificent new house of the Boston City Club, where there is every facility for entertaining the delegates, and which is centrally located. The meeting will be promoted by a publicity committee consisting of Palmer York, Boston; H. S. Knowlton (Electrical World), Cambridge; W. B. Conant (Electrical Review and Western Electrician), Concord, chairman; Albert Weatherby, Boston, and William W. Scott (Motor Truck), Pawtucket, R. I.

TO MOTORIZE FIRE DEPARTMENT.

At an estimated cost of $140,000, it is expected that the fire department of Providence, R. I., will be completely motorized in the near future. At the recent state election it was voted to give the firemen one day in five off duty, and a request has been made for 40 additional men for Providence. It is believed that, if motor equipment is installed, this number can be cut in half and if so, the salaries saved will pay for the new apparatus in a very few years. The motorization of the department has been contemplated for some time, but it has not been thought advisable to do it all at once, motor equipment being bought only as the old apparatus has worn out. The new condition, however, seems to make a complete change advisable, and it is thought that it will be brought about.

GMC MAKES BIG SAVING IN COST.

The record of a five-ton GMC truck, operated by the American Oil Company, New York City, is of much interest as showing a very large saving over the cost of horse drawn vehicles performing the same service. Four trips a day are made from Gutenburg, N. J., to the wholesale district, with a load well up to the capacity of 20 barrels, at an average daily cost of $12.60, which covers operation, maintenance, interest, insurance, etc., the cost a barrel, for 80 barrels a day, being 15¾ cents. The former method was to ship the oil by lighter from Gutenburg to pier 36, from which it was hauled to the jobbing district by contractors, the cost of transportation being 12 cents a barrel for lightering and 20 for haulage, a total of 32 cents. In addition to this saving of one-half of the cost of moving the oil, there has been an even greater saving in time. Shipping the old way, delivery took at least 24 hours and frequently 48, whereas the motor makes the run in one hour and 10 minutes. The truck is making a cash profit of $13 a day over the former expense, besides giving immensely better service, to the customer, which is expected to have a very pronounced effect in developing business, which will increase present profits.

Mack 6000-Pound Chassis, Equipped for Hose and Chemical Service—The New York City Fire Department Has 20 of These Machines.

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GOODYEAR WILL SELL MOTZ TIRES.

Beginning Feb. 1 the sale of the products of the Motz Tire & Rubber Company will be through the Goodyear Tire & Rubber Company, which will distribute all Motz power wagon and truck tires and will make all adjustments. The promise is made by the Goodyear Company that users of Motz tires will have better service than ever before because of the facilities of the Goodyear branches, Motz tires now being handled by distributors, and after Feb. 1 the same sales methods and policies will apply to the Motz lines as to the Goodyear.

The sale of Motz tires will be by the Goodyear motor truck tire department, of which C. W. Martin, Jr., is manager, and preparations are now making for the stocking of the Goodyear branches and informing the selling representatives.

FREIGHT HANDLING AT TERMINALS.

"The Delivery and Handling of Miscellaneous Freight at the Boston Freight Terminals" is the title of a pamphlet by Prof. Harold Pender, H. F. Thomson and C. E. Eldred, which is a statement of an investigation made by the electrical engineering department of the Massachusetts Institute of Technology, together with discussion of the report, by the Railroad Club of New York City. The paper was read at a meeting of the club, discussed, and is now issued in booklet form. It contains an analysis of the time spent by wagons in the freight yard and an analysis of the time between the arrival of trains in the yard and the delivery of freight. The document is well illustrated with cuts and diagrams, and contains some interesting tabulations.

REGULATION OF PASSENGER RATES.

Consideration is being given by the assembly of St. Louis, Mo., to a bill to fix the rates to be charged for motor vehicles which are rented. The proposed schedule of rates is: For machines carrying four passengers or less, $4 for the first hour and $3 for each additional hour. Vehicles of greater capacity may be charged for at $4 for each hour. The taxi rate is 40 cents for one or two passengers for the first half-mile, with an additional charge of 10 cents for each quarter-mile thereafter, and for each passenger over two the charge will be 20 cents for the whole trip. Waiting is to be charged for at the rate of 10 cents for each five minutes.

FEDERAL TRUCKS FOR WAR.

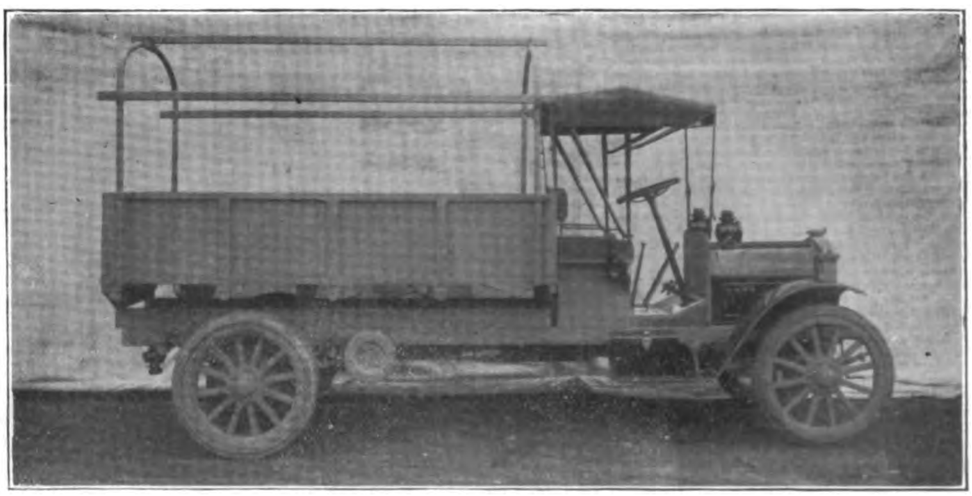
Specially Equipped 3000-Pound Machine for Russian Army Service.

The Russian government, which in common with England and France turned to the United States to obtain motor vehicles for army service at the opening of the European war, has made contract with the Federal Motor Truck Company, Detroit, Mich., to supply a considerable number of these machines. The proportions of the contract has not been made public, but there is reason to believe that this order will take all of the wagons that can be produced in excess of the normal demand for several months at least.

The experience of the Russian army has been that a 3000-pound unit is the best suited for all-round requirements, and this size has been adopted for general transportation, although this is not used for the haulage of heavy guns. The mobility of the machines and the comparatively high speed at which they can be operated in all conditions of service are the reasons why the type and size has been approved.

The chassis is the standard chain driven type, but the body is special, this being an open express construction with high sides and ends, with end gate, and adapted for carrying bulky loads. The body is fitted with two curved bows at either end, these being strengthened with three longitudinal members, and these support a tarpaulin top, which can be removed. The illustration shows the body and top bows without a covering. The bows are carried in solid sockets and the top can be removed or erected in a comparatively short time.

One series of trucks of this type was equipped for field ambulance service, having similar form of top, but adapted for carrying two tiers of stretchers, so that these could be used for removal of the wounded, or in the event of need quickly transformed for the transportation of food or ammunition or equipment. The numerous uses possible with these machines has made them extremely satisfactory in any service.



Federal 3000-Pound Chassis Fitted with Special Body and Removable Top, for Service of the Russian War Department.

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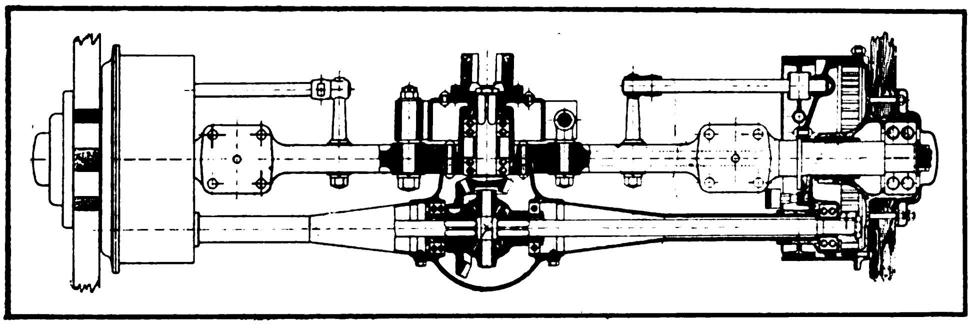
POWER TRANSMISSION SYSTEMS.

Internal Gear Drive Affords Constant Efficiency and Extreme Service.

The purpose of all motor wagon and truck engineers is to conserve power, the objects being to minimize wear of parts in frictional contact and obtain the highest degree of efficiency at minimum consumption of fuel and lubricants. The four means of transmitting power to the road wheels the vogue with engineers are by shaft through a divided axle shaft, by shaft to a divided jackshaft and by chains and sprockets to wheels turning on a dead rear axle, by shaft, worm and gear wheel to a divided rear axle shaft, and by shaft and a divided driving shaft through pinions meshing with internal gears mounted on the rear wheels.

Of these the shaft is only used for light freight wagons, the chains are very generally installed for all work, but the demand for constant efficiency, which can only be obtained through thoroughly protecting the driving systems against accumulations of dust and dirt, which adhere to the lubricant and transform it into an abrasive, has impelled the engineers to devise means of housing the moving parts. The engineering difficulties met with in obtaining the necessary gear reduction at the rear axle militate against the shaft and bevel gear and pinion type of drive. The chains can be used with cases that enclose them, but these are not regarded as being successful because of the large wheel sprockets that necessitate them being close to the ground, entailing hard usage on rough roads or from highway obstacles.



The Internal Gear Driven Type of Rear Axle Adopted for the Construction of Fremont-Mais 3000 and 5000-Pound Trucks.

The other forms of protected driving systems are the worm and gear wheel, and the internal gear. The former has been highly developed in England, there being two types, the Lanchester, with the worm below the gear wheel, and the David Brown, with the worm above the gear wheel. The internal gear has been equally highly developed in the Mercedes trucks in Germany and the Latil trucks in France, in both of which the endurance has been extremely high. In the course of investigations of American engineers into the qualities of these machines, the wearing qualities of the gears, one set having been 13 years in service on a Mercedes truck, and another nine years on a Latil truck, were regarded as being the greatest evidence of the efficiency of the constructions. In one engineer's opinion the gears seen were good for a million miles driving.

The internal gear transmission system has been adopted for the Fremont-Mais 3000 and 5000-pound trucks, built by the Lauth-Juergens Motor Car Company, Fremont, O., and this particular construction is regarded as the highest development of this form of drive. The power is transmitted equally efficiently, no matter how long the period of service, for there is no frictional loss save in the bearings, and being perfectly lubricated, thoroughly protected against wear from abrasion, and constructed of high-quality materials, the fuel consumption is minimized and the full power developed is transmitted to the road wheels.

FOREIGN IMPORT DUTIES.

"Foreign Import Duties on Motor Vehicles and Accessories" is the title of a pamphlet issued by the bureau of foreign and domestic commerce of the Department of Commerce, which is of much value to every manufacturer, sales agent or firm that is engaged in, or may receive orders for, exportation of machines parts, equipment, accessories or supplies. The pamphlet is designated as No. 30 of the tariff series, and is revised to November, 1914. It was compiled by L. Domeratzky, chief of the division of foreign tariff, and it includes general information of details, such as ad valorem duties, dutiable values, specific duties, dutiable weight, preference and discrimination, classification, temporary provisions and tariff changes, and a summary statement of rates of duties on motor cars, motor trucks, motorcycles and tires imported from the United States into foreign countries. It also includes a schedule of the import duties of the different countries as applies to motor vehicles and accessories. The data are, of course, subject to change from time to time, but may be supplemented by information obtained by direct inquiry from the bureau.

The Pull-More Motor Truck Company has been incorporated at Augusta, Me., with capital of $500,000, to engage in the manufacture of automobile vehicles, gasoline motors and all kinds of machinery. E. M. Leavitt of Winthrop, Me., is president and treasurer.

The Revere Rubber Company, Providence, R. I., is producing a very large order of motor truck tires for use on machines in the service of the French and Russian armies. The facilities of the plant are worked to capacity and overtime to fill the orders.

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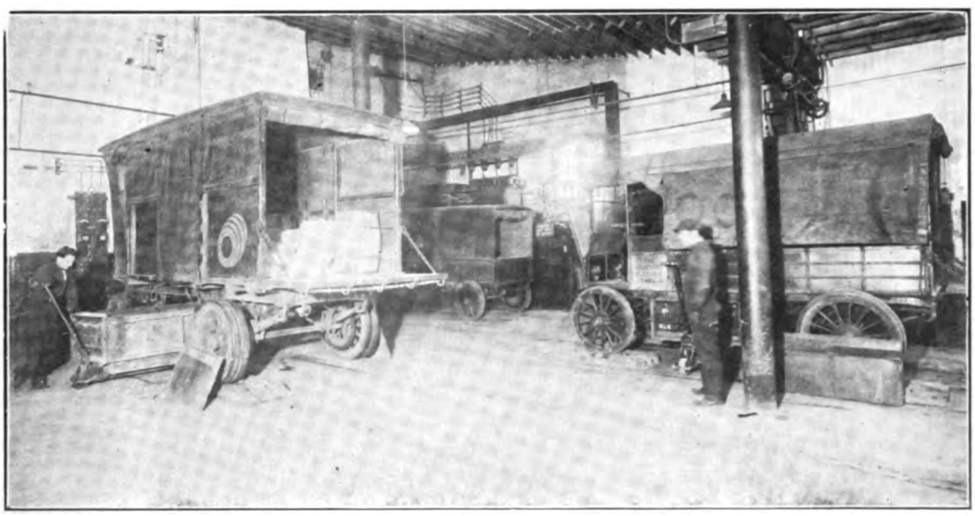
VEHICLE BATTERY EXCHANGE SYSTEM.

Practical Results from Viewpoint of Central Station and Owner, Realized by Three Years' Successful Experience of the Hartford Electric Light Company.

CENTRAL station co-operation with manufacturers and users of machines has been advocated by all who have sought to promote more general utilization of electric vehicles. Possibilities and probable results have been estimated from practically every angle. Without discussing details, the prevailing attitude of the central stations has been to question the advisability of either making investment or concentrating endeavor, first because of the limited probable revenue, and second because of the assumption that such business as might be developed would be foreign to the general distribution of light, heat and power.

The manufacturers of electric machines and those selling them have claimed that the central stations could as consistently promote the use of electric vehicles as any other utility for the operation of which power is required. The purchasers of machines, or those investigating their use for transportation, have maintained that absence of "service", which might be afforded by builders of cars, wagons and trucks or by central stations, has militated against the more general adoption of electric conveyances.



The Battery Exchange Room at the Kinsley Street Station, the Wagons Being Over the Hydraulic Jacks That Raise and Lower the Trays of Cells.

The activities of the Electric Vehicle Association of America, the membership of which is largely central stations, electric vehicle and accessory manufacturers, are generally to concentrate promotion work where it will be most effective and which will be beneficial to every interest.

In no sense has there been crystallization of policy that would seem to be a solution of the situation with reference to the central stations and the electric vehicle industry, and this materially influences against the purchasing and use of machines. Pleasure cars were developed before freight vehicles were considered practical, although both types of electrics were nearly contemporary in the market, but following the experience of the gasoline automobile amusement was the primary object of the buyers. Of the 1,750,000 motor vehicles in America approximately five per cent. are used for freight purposes. Perhaps another five per cent. is utilized for business in differing ways.

Few Electric Vehicle Garages.

Manufacturers of gasoline cars have branches, agencies and representatives, and there are many thousands of garages where service can be obtained—that is, the advice and assistance that is necessary to insure reasonably satisfactory operation and efficiency. There are garages where electric pleasure cars can be stored and given attention, but the garages that are exclusively for electric wagons and trucks are comparatively few.

This explanation is desirable to understand the peculiar situation and the conditions in which the Hartford Electric Light Company, Hartford, Conn., has undertaken to promote the use of electric wagons and trucks purely as a business proposition, rejecting pleasure cars and developing what is undoubtedly the most difficult field to exploit. The company became agent for General Vehicle machines for Hartford and vicinity. It had precisely the same demands made upon it that are made by agents and owners upon other central stations. There was no reason for experience to be otherwise.

To succeed with its agency was desirable, but not necessary for the welfare of the company. There were then several garages in Hartford that specialized with electric pleasure cars. This business was not desired or considered. What was wanted was public knowledge of the real utility of the electric wagon or truck, and confidence that the full utility could be obtained.

Initial Battery Exchange System.

The company then adopted a battery exchange system, this being the first service of the kind of the world, and which has now been operating for about two and a half years. Since that time another company, the Washington Water Power Company,

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Spokane, Wash., has instituted a similar service. There are in Berlin, Germany, similar services conducted by two private companies for taxicab batteries, but the German concerns have no interest in increasing power consumption, nor profiting by vehicle sales.

The service of the Hartford Company has been regarded as an experiment and, while the possibilities are generally understood by central station managements, no other concerns have undertaken what has been proven to be a practical method of increasing the current consumption and a foundation for future business that seemingly has extremely broad possibilities.

In summarizing the condition with which the company has dealt the following statement may be made, as it satisfactorily explains the possibilities of the battery exchange system from the viewpoint of the central station:

The investment in batteries is justified on the part of the central station because these batteries are a direct means of selling power in very much the same way that transformers, transmission lines, etc., are accepted as a proper investment for the central station.

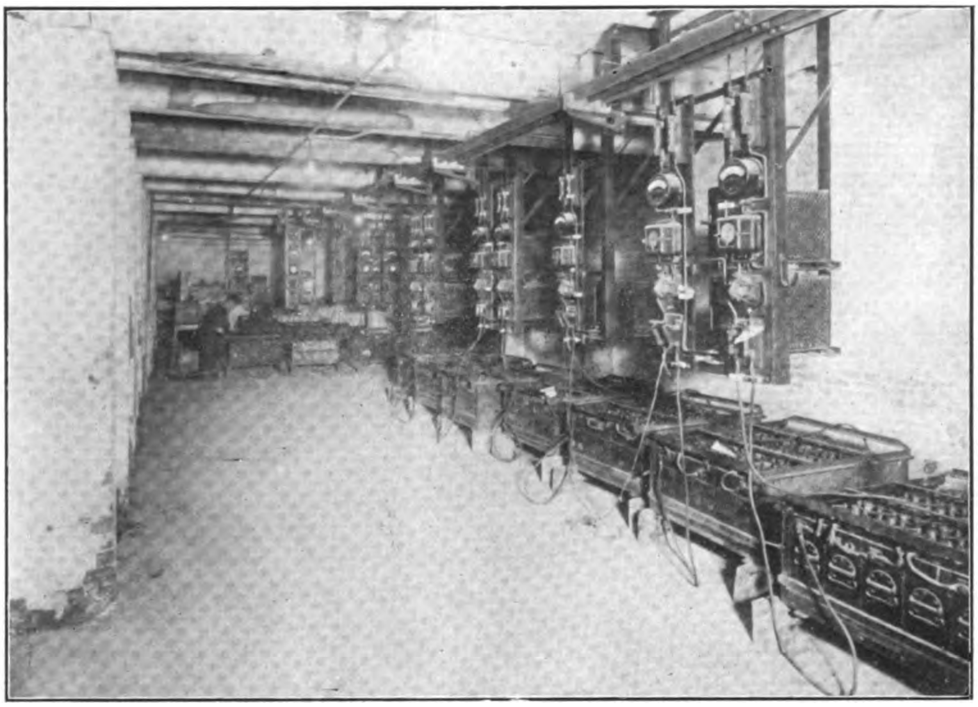
The load developed in this way is much more exactly under the control of the central station than any other type of load. The system saves a considerable investment in lines, etc., which would be required to handle the electric vehicle business in the usual way. A battery service of this kind makes the electric truck a really practical piece of apparatus for the business man, and is, therefore, a means of introducing electric vehicles.

The truck buyer approves of such a service, since his investment is considerably reduced, and the most uncertain elements in the operation of electric trucks are reduced to a definite contract basis; that is, the items of depreciation and charging current. The truck buyer is relieved from any investment in charging equipment, and does not require a man experienced in battery practise.

Billing a business man on a mileage basis for a service of this kind is billing him for something which he definitely understands. The truck user has a great advantage in the fact that a truck may be worked for any number of hours a day to meet the requirements of a business.

The General Plan of the System.

The company became agent for the General Vehicle Company in 1910. Then wagons or trucks were sold with batteries to any person desiring them and, that there might be minimized expense for garaging, etc., the company placed its own garage at their command, making a flat rate for storage and washing, and charging a graduated scale for current. The owners were expected to furnish their own supplies and to pay for adjustments and repairs, but a periodic inspection was guaranteed. At that time the company had its garage in Pearl street, and some available storage space in the battery station in Kinsley street.



The Battery Charging Room at the Kinsley Street Station, the Batteries Being on Wood Blocking to Obtain Height for Using the Cown Jacks.

The battery service was developed after considerable study, and without precedent, so that many of the factors were unknown and were based on estimates, and for this reason there was no assurance that what would be established for rates or service would be continued. The plan was made by A. C. Dunham, former president of the company. It was to sell to a business man any type of vehicle desired without battery, and to provide a battery for the machine whenever necessary, to afford normal or abnormal mileage, and to make charge for current practically the same as is charged for power service, but on a basis of vehicle miles travelled. Two scales were drafted, the one where the owner requires no charging apparatus or garage, and the other where the customer furnishes charging apparatus approved by the company. The service is based on a yearly contract and the bills are made to cover a month.

The Facilities Needed for the Service.

To provide batteries the company must make the investment that is usually made by the owner, it must locate a battery station at a convenient place, equip it with efficient charging facilities, have equipment for quick changing, and have a sufficient reserve so that

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any consistent demand could be met. To insure reasonable profit there must be a specific service charge, for the basis is mileage, and were there work that would greatly vary, or where vehicles could be withdrawn from service for a considerable period, without the service charge, the company would receive only the mileage price, which would necessarily be high.

Purchasing batteries, the company must make the original investment, and the operating cost includes interest, taxes, insurance, depreciation, maintenance, repairs and careful supervision, as well as light, heat, rent and clerical work. Besides, a high state of efficiency is necessary, for an owner must make a stated mileage and economical considerations demand the fewest number of extra batteries to meet the requirements. The company decided that it would adopt Edison batteries for its service.

In this connection, statement should be made that there is no reason why lead-acid batteries cannot be used with a service of this kind with positive success and assurance of profit. Batteries of this type are the equipment in the service of the companies affording the same system for taxicabs in Berlin, and these have been found to give satisfactory results. Practically the same methods would obtain. The Hartford Company elected to make its equipment as stated, and it is continuing this equipment as the demands are increased.

The scale of prices for the service, as stated, applies to two classes, No. 1 and No. 2. No. 1 is for battery exchange without reference to number used or the time exchanged, and the batteries are taken out of and placed in vehicles at the Kinsley street station. Scale No. 2 applies to vehicles in which a battery is charged at the garage of the Commercial Electric Vehicle Company at 1271 Main street at night, but should there be additional mileage desired another battery is installed at the Kinsley street station at demand. These scales are as follows:

SCALE NO. 1.

Monthly scale of charges under the Edison battery service system as furnished by the Hartford Electric Light Company, with the General Vehicle Company's standard wagons and trucks. No charging apparatus or garage required:

750-Pound Wagon.

Fixed charge, per month...........			$15
Rate per mile......................	0 to 500	2½c	
Rate per mile......................	501 to 750	2¼c	
Rate per mile......................	751 to 1000	2c	
Rate per mile, in excess of........	1000	1½c	

1000-Pound Wagon.

Fixed charge, per month..........			$20
Rate per mile......................	0 to 500	3c	
Rate per mile......................	501 to 750	2½c	
Rate per mile......................	751 to 1000	2¼c	
Rate per mile, in excess of........	1000	2c	

2000-Pound Wagon.

Fixed charge, per month...........			$30
Rate per mile......................	0 to 500	3½c	
Rate per mile......................	501 to 750	3c	
Rate per mile......................	751 to 1000	2½c	
Rate per mile, in excess of........	1000	2c	

4000-Pound Wagon.

Fixed charge, per month..........			$40
Rate per mile......................	0 to 500	4½c	
Rate per mile......................	501 to 750	4c	
Rate per mile......................	751 to 1000	3½c	
Rate per mile, in excess of........	1000	3c	

7000-Pound Truck.

Fixed charge, per month...........			$50
Rate per mile......................	0 to 500	6c	
Rate per mile......................	501 to 750	5c	
Rate per mile, in excess of........	750	3c	

10,000-Pound Truck.

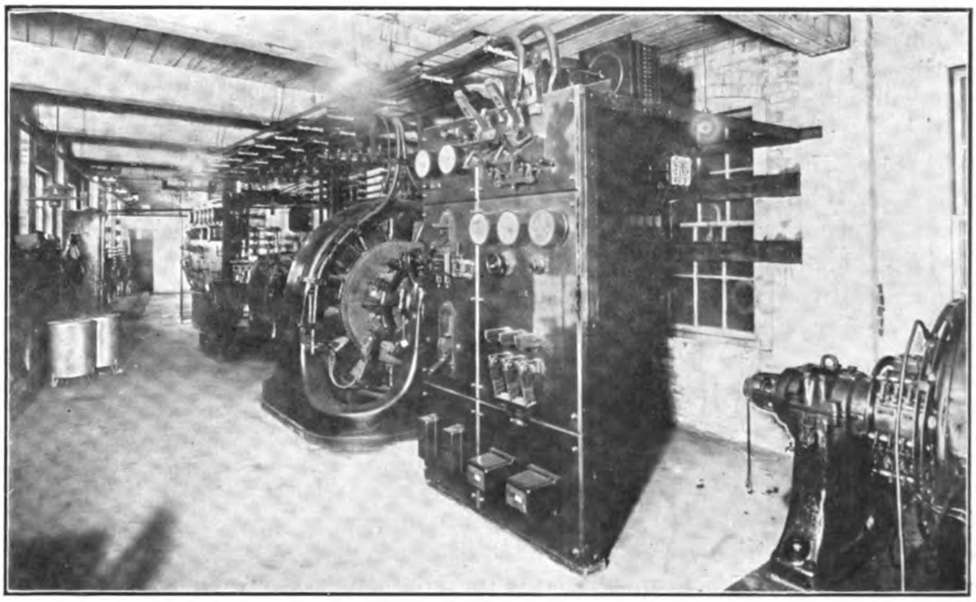
Fixed charge, per month..........			$60
Rate per mile......................	0 to 500	7c	
Rate per mile......................	501 to 750	6c	
Rate per mile, in excess of........	750	4c	

SCALE NO. 2.

Monthly scale of charges, under the Edison battery service system, as furnished by the Hartford Electric Light Company; battery charged in wagon at night, where the customer furnishes charging apparatus on premises approved by the Hartford Electric Light Company:

750-Pound Wagon.

Fixed charge, per month..........			$10.50
Rate per mile......................	0 to 500	2½c	
Rate per mile......................	501 to 750	2¼c	
Rate per mile......................	751 to 1000	2c	
Rate per mile, in excess of........	1000	1½c	



The Charging Plant at the Kinsley Street Station, This Furnishing the Current Used to Charge the 85 Batteries in Constant Service.

1000-Pound Wagon.

Fixed charge, per month............			$14
Rate per mile......................	0 to 500	3c	
Rate per mile......................	501 to 750	2½c	
Rate per mile......................	751 to 1000	2¼c	
Rate per mile, in excess of........	1000	2c	

2000-Pound Wagon.

Fixed charge, per month..........			$21
Rate per mile......................	0 to 500	3½c	
Rate per mile......................	501 to 751	3c	
Rate per mile......................	751 to 1000	2½c	
Rate per mile, in excess of........	1000	2c	

Outline of Service Contract.

The contract requires the company to furnish the customer continuous battery service for use with General Vehicle wagons and trucks in accordance with the schedule stated, and the company to own, maintain and supply all batteries necessary for the operation of the machines, and to charge, install and exchange the batteries. The owner is required to own and maintain the vehicles for which he has contracted for service; to keep them in a reasonable state of repair and

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properly oiled. The customer agrees to bring the machines to a central location, where suitable apparatus for the rapid exchange of the batteries is maintained. The owner agrees to the mileage registered by an odometer furnished by the company as the correct basis for rendering bills, and the company is required to keep the odometer in good repair and shall check the accuracy of the odometer when requested. In the event of the odometer failing, the mileage is to be estimated from previous records until the instrument shall be replaced. The owner assumes no responsibility for batteries or odometer, except in the event of accident or fire when these are not under the control of the company. The company assumes no responsibility for the damage to vehicles by reason of fire, accident or other cause. The company is required to have a regular inspection made of the vehicles once a month, or not oftener than twice a month. In event of a discharged battery being exchanged for a charged battery the company furnishes the driver a coupon showing the number of miles the battery should propel the vehicle; in the event of this battery mileage being exceeded a charge is made for "towing in". If a customer desires to withdraw his vehicle from service for a period of not less than a month, he may have the battery charges cancelled by giving advance notice in writing, and the company is to have three weeks' notice in writing of the intention to renew the service. This contract means that a practical business arrangement is made, for transient or periodic battery exchange service could not be provided.

Actual Cost of Service.

Considering the service that is to be obtained by the owner, the better way is to quote actual performance, which will show four different vehicles, one of 750 pounds capacity, one of 1000 pounds, and two of 2000 pounds, these being representative from every point of view. These will be designated by the registration number, which is the basis of the company's record.

750-POUND WAGON, NO. 2625.

		Battery Exchange Service Cost.		
			Scale	Scale
Operating data		Mileage	No. 1	No. 2
Period of service, months...	28	0 to 500	$12.50	$12.50
Total mileage	31.361	501 to 750	5.62	5.62
Monthly average mileage....	1,120	751 to 1000	5.00	5.00
Working days a month......	25	120 excess	1.80	1.80
Average daily mileage......	44.80	Fixed charge	15.00	10.50
Maximum monthly mileage...	1,234			
Minimum monthly mileage..	179			
Average monthly cost...........................			$39.92	$35.42
Average cost a mile...........................			3.57c	3.17c

1000-POUND WAGON No. 3435.

		Battery Exchange Service Cost.		
			Scale	Scale
Operating data		Mileage	No. 1	No. 2
Period of service, months....	17	0 to 500	$15.00	$15.00
Total mileage	18,632	501 to 750	6.25	6.25
Monthly average mileage....	1,096	751 to 1000	5.62	5.62
Working days a month......	25	96 excess	1.92	1.92
Average daily mileage.......	43.82	Fixed charge	20.00	14.00
Maximum monthly mileage..	1,392			
Minimum monthly mileage..	577			
Average monthly cost...........................			$48.79	$42.79
Average cost a mile...........................			4.46c	3.91c

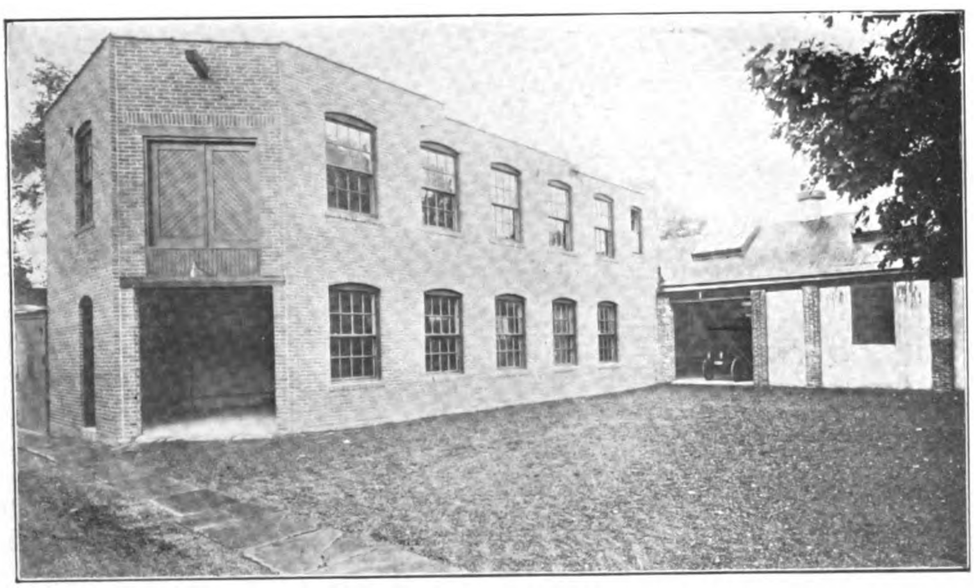
2000-POUND WAGON, NO. 3659.

		Battery Exchange Service Cost.		
			Scale	Scale
Operating data		Mileage	No. 1	No. 2
Period of service, months..	7	0 to 500	$17.50	$17.50
Total mileage	8,895	501 to 750	7.50	7.50
Monthly average mileage....	1,271	751 to 1000	6.25	6.25
Working days a month......	25	271 excess	5.42	5.42
Average daily mileage......	50.84	Fixed charge	30.00	21.00
Maximum monthly mileage..	1,384			
Minimum monthly mileage..	1,138			
Average monthly cost...........................			$66.67	$57.67
Average cost a mile...........................			5.25c	4.54c

2000-POUND WAGON, No. 3971.

		Battery Exchange Service Cost.		
			Scale	Scale
Operating data		Mileage	No. 1	No. 2
Period of service, months...	5	0 to 500	$17.50	$17.50
Total mileage	5,733	501 to 750	7.50	7.50
Monthly average mileage....	1,147	751 to 1000	6.25	6.25
Working days a month......	25	147 excess	2.94	2.94
Average daily mileage.......	45.88	Fixed charge	30.00	21.00
Maximum monthly mileage..	1,323			
Minimum monthly mileage..	1,025			
Average monthly cost...........................			$64.19	$55.19
Average cost a mile...........................			5.51c	4.82c

In considering these data one will note that the cost with both scales is given, and, of course, in regular service but one scale could be applied. The purpose is to illustrate the expense with either and to show actual operating cost.



The Garage of the Commercial Electric Vehicle Company, Main Street, Where Vehicles Stored Have the Benefit of the No. 2 Scale of Rates.

Applications of the Scale.

With reference to scale No. 1. The purchaser of a vehicle pays the price less the quoted cost of the battery. He has no available place for storage. He can make contract with the Commercial Electric Vehicle Company for storage at its garage, and for this storage he is charged $100 a year for a 750, 1000 or 2000-pound wagon, this being $8.33 a month. This charge includes the ordinary oiling and greasing of the ma-

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chine. When a vehicle is washed the work is ordered by the owner and each washing costs 50 cents. Material and parts for repairs can be obtained at this garage and labor is charged at 60 cents an hour. As inspection is made twice a month, the owner has assurance that his machine will be kept in good condition, if he authorizes the work, and the contract with the company for battery service requires such maintenance that there is no excessive use of current. Aside from the driver's wage, the renewal of tires, the cost of parts and material for repairs, the labor making repair, the washing, and the necessary periodic overhaul and painting, the owner has no other operating expense that is not covered by the service cost. He will have the overhead, which will include interest on investment, taxes, insurance and the charge for depreciation to assume.

These charges will be relatively smaller than when the battery was purchased. The depreciation period can be computed on the basis of 125,000 miles of vehicle service, or approximately 10 years, because he will necessarily have to maintain it to continue the service, and the expense will be in ratio to the maintenance.

Considering scale No. 1. The purchaser of a machine may store it in a stable, a small garage, a shop or factory. He can send it to the garage of the Commercial Electric Vehicle Company for inspection, washing, adjustment or repair or overhaul, paying for whatever service he may order. He will have practically the same operating expense and overhead and depreciation. He saves the garage cost, but the driver must be responsible for the oiling and greasing. The vehicle is sent to the garage when necessary, but it must go to the Kinsley street station for exchange of batteries. As a rule batteries are exchanged daily, but in a number of instances where the mileage is considerable two batteries are used.

Lessened Mileage from Poor Traction.

Here is a very important fact. An electric battery and instruments afford the most accurate means for recording power necessary for doing a given work. With any increase of the load greater power is necessary, and with a given load any variance from a perfectly smooth, level surface will necessitate greater current consumption. The owner, with the battery exchange system, buys mileage at stated prices, and with the increased use of current the rate lessens. Any condition that affects the vehicle, such as grades, muddy or slippery paving, greasy macadam or gravel roads, rain, ice, snow, rutted surfaces, or frozen mud that is rough, all cause a draft of additional current, without increasing the mileage. Or, to put it another way, these causes will reduce the mileage of a given battery and lessen its productiveness.

The Main Floor of the Garage, Showing an Auxiliary Charging Panel and the Charging Stations Located Along the Walls.

But the company is selling mileage, and this is indicated by the odometer, no matter how much current is used to drive a mile. There is very wide variance in current use, and taking a vehicle that is driven over the same route with a load of the same weight each day as a standard of 100, the consumption will at times reach 175, or even in excess of that figure because of the road conditions. The demand for batteries is greater when more current is consumed, especially by those wagons that cover long routes.

Ratio of Batteries to Vehicle.

In maintaining the battery exchange the company has found that 1.4 batteries per vehicle is approximately needed to meet every demand upon it. That is, 1.40 batteries to a wagon will be adequate, basing expectations upon experience. The exchange system is used by the owners of 58 different machines, of which 11 are 750 pound, 22 are 1000 pound, 22 are 2000 pound and three are 4000-pound capacity. Of these about 30 are garaged at the station of the Commercial Electric Vehicle Company, 15 are stored in places for the convenience of the owner, and the remainder at the garage of the Hartford Electric Light Company in Pearl street. Some idea of the development of the service may be gained from the following statement of vehicles served:

Vehicles	750 Pounds	1000 Pounds	2000 Pounds	4000 Pounds	Total
Jan. 1, 1912	5	6	3	0	14
Jan. 1, 1913	8	14	8	0	30
Jan. 1, 1914	8	20	16	2	46
Nov. 30, 1914	11	22	22	3	58

Monthly Averages of Mileage.

The record of accumulated mileage is especially interesting, as it shows the work done. Taking the above dates and giving the total of the battery miles of record to correspond the respective totals are: Jan. 1, 1912, 90,174; Jan. 1, 1913, 233,131; Jan. 1, 1914, 574,900; Nov. 30, 1914, 937,739. The record showing the accumulated mileage is worthy of careful study. Exact 100,000-mile periods are not practical to obtain,

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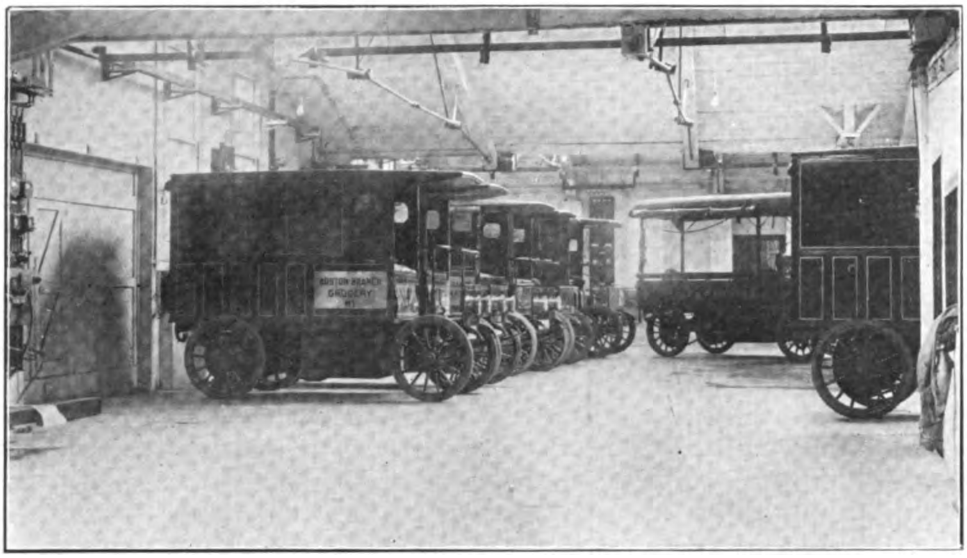
but the nearest to these show that from April 1 to Dec. 1, 1912 (eight months), the average monthly mileage was 12,075; from Dec. 1, 1912, to May 31, 1913, the monthly average was 19,846; from June 1 to Aug. 31, 1913, the monthly average was 28,324; from Sept. 1 to Nov. 30, 1913, the monthly average was 33,-532; from Dec. 1, 1913, to April 1, 1914, the monthly average was 27,101; from April 1 to June 30, 1914, the monthly average was 36,843; from July 1 to Sept. 1, 1914, the monthly average was 41,633, and from Sept. 1 to Dec. 1, 1914, the monthly average was 42,379.

Adaptability of Service.

The battery service is now used by firms dealing in bottled goods, groceries at wholesale, coffee, men's furnishings, groceries at retail, drugs, ice cream, coal, hay and grain, furniture, department stores, newsdealers, expressing, trucking, baking, laundry and milk distribution.

Dec. 1 daily mileage for the preceding three months, allowing 25 working days to the month, was 1695, and for the 58 machines in use this was an average of 30.949 miles a day. During this period the number of vehicles was increased from 54 to 58, and to allow the full number the daily average for the three months somewhat reduces the actual figure, which was considerably in excess of 1700 miles. Not only this, two wagons, used for bottled goods and ice cream delivery, showed greatly decreased mileage, and then were withdrawn from service for winter months. These facts are stated to show that the daily average of each machine was really considerably more than is indicated by the figures given.


The Garage When the Wagons Are Returning for the Day, the Batteries in the Machines Being Charged During the Night.

Daily Mileage of Vehicles.

Very frequently the mileage will exceed 1800 miles daily, and occasionally 1900 miles. For instance, Oct. 3 the total was 1959 miles, and Oct. 24 it was 1922 miles. In one month two 2000-pound wagons were driven 2776 miles, this being an average of 1388 miles each, or 55.5 miles each for 25 working days. The greatest mileage for any one vehicle for a single day thus far is 88, made by a 2000-pound wagon. Two batteries were used.

The following statement relative to batteries is especially interesting:

Wagon Capacity	No. Wagons	No. Batteries	Battery Ratio to Wagons
750 pounds	11	17	1.545
1000 pounds	22	34	1.545
2000 pounds	22	30	1.363
4000 pounds	3	5	1.666
Total	58	86	

This shows that the average ratio of batteries owned to wagons served is 1.530, but there is an excess of batteries according to the experience of the company, for very careful observation has proven that 1.4 batteries will suffice for any demand that has yet developed.

The batteries are charged at the Kinsley street station, where 37 charging stations are available at one time, and there as soon as batteries are brought in they are placed on charge, and so far as possible current is stored at the Edison battery normal rate of charging for the seven-hour period. If necessary, however, these batteries can be boosted at whatever amperage is desirable. The exchanges are made at whatever time will best suit the convenience of the owners.

The machines kept at the garage of the Commercial Electric Vehicle Company are charged there at night, the drivers taking them to the garage with the second battery used during the day, or with the battery first taken out if the mileage is not excessive. The charging is intended to bring all the batteries in the vehicles up to capacity, so that all may do as much work as is possible without changing. But those kept at places outside the garage are sent to the Kinsley street station for an exchange, usually when the work will bring the nearest without making a special trip. This saves time and current.

The battery room is of considerable size and the batteries are each placed on two sections of timbers, practically as long as the battery tray is wide. All of the wagons are fitted with universal battery trays, these being in effect a bottom and two ends, with two removable sides. The trays are held in the chassis by latches at each corner, that are mounted on the chassis frame and are secured under flanges at the tops of the end sections. These latches are moved by pinch bars. The battery and the tray are kept together. The sides of the tray are interchangeable. A Cown jack is used for handling the batteries. By pushing the jack under the battery and lowering the handle the battery is raised clear of the timbers, and

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it can then be drawn into the exchange room.

In this exchange room are two hydraulic jacks, each with four pistons, the platforms of which are level with the floor. The wagon is driven into four channels, one for each wheel, so that the battery tray is directly over the hydraulic jack. A Cown jack is run on the hydraulic jack. The water pressure is turned on and the hydraulic is carried up until the Cown jack is lifting the tray. When the jack has reached a height so that the latches can be released it is stopped. The sides are removed, the latches pressed back, and then the hydraulic jack is lowered to the level of the floor. The Cown jack and the tray are then drawn into the battery room, and the tray is deposited on the timber seat by lowering the handle and then raising it.

The changing is done by crews of two stout boys, and the time required will range from 2½ to four minutes. Without knowledge that they were being timed one crew changed the batteries in a 750 and two 1000-pound wagons in two minutes 35 seconds, 2 minutes 45 seconds and two minutes and 50 seconds, and in a 2000-pound wagon in three minutes and five seconds. When the work was planned five minutes was the time allowed for exchanging, but it can be done in two minutes in favorable conditions. With more Cown jacks and batteries ready in the exchange room much faster work can be done. Five minutes is a very liberal allowance. Two batteries can be changed at a time. With the present equipment several hundred batteries could be handled each day if arrangements were made for the drivers to be ready at specific times, so there would be no congestion of vehicles.

One-Ton General Vehicle Wagon Used for Milk Delivery and Operated from a Farm at Rocky Hill, Seven Miles from the Kinsley Street Station.

Service from a Distance.

One of the possibilities with the service is the distance a wagon can be operated from the battery station. W. F. Griswold has a farm at Rocky Hill, seven miles distant. He has nearly 100 cows and produces more than 1000 quarts of milk daily, which is distributed by two routes in Hartford. The milk is high quality, the milking being done by electricity, and excellent prices are obtained. The longest route was 25 miles, on which was delivered about 625 quarts of milk and cream, and serving this in the summer three horses were used, each making 25 miles for two days and resting the third day. In winter four horses were used, each pair being worked alternate days. On the other route the work was not as hard and the animals could be worked fairly regularly in summer, and alternated in winter, as conditions required.

Milk was delivered each day at the store of the Boston Branch Grocery, which operates the largest number of electric wagons in service in Hartford. After observing these for a considerable period, and learning of the battery exchange system, Mr. Griswold called on Manager Thayer and ordered a 2000-pound wagon, which was delivered July 18. This machine has been operated each day since delivery, being driven by a son of the owner, who was experienced in driving gas cars, and each day at noon the battery is exchanged. The mileage at this season is approximately 25 a day.

Large Saving with Electric.

The young man serves 325 customers, which means that many stops, and while the actual delivery is largely a matter of "legs" when distribution is begun, for the milk is delivered even to the fourth floors of buildings; with a boy he leaves the farm at 6 o'clock and is back by 1:30. A typical load was 22 cases of 12 quarts, 12 cases of 20 pints, in bottles, four 40-quart, one 30-quart and two 10-quart cans. This was a total of 594 quarts of milk and cream, weighing, with the containers, about 2500 pounds. The wagon is driven under a shed at the farm, there not even being a garage.

During the period of the year when the crops are harvested the wagon is loaded with produce or fruit and makes a second trip to Hartford, this bringing the mileage for the extra trip days to 40 or 45, but during the winter the route alone is covered. The monthly mileage will range from 750 to 800 in winter and from 150 to 200 miles more in the warm weather. Since the electric wagon was purchased the number of horses used for the farm has been reduced from 16 to 10, so the machine can be regarded as practically replacing six of them. Since the wagon has been in use

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but one delay, for a half hour, has been experienced, and the driver says that he never could have done as well with animals.

At 750 miles a month the battery service will cost $55, and on a basis of 30 working days this is a total of $1.83 a day, or at 25 miles, approximately 7.33 cents a mile. This statement applies to the battery service and does not include the other operating, maintenance or overhead charges.

Service Records Simplified.

The records kept in connection with the service have been simplified and are extremely comprehensive. The first of these is the Daily Battery Exchange Record. This covers a period of 24 hours, and the sheet has ruling for 30 entries. Under the date the record is divided into two parts, "Batteries Taken Out" and "Batteries Put In". Under former, from left to right, the entries are filled as follows: Battery No., Taken Out of Car No., Odometer Reading, Miles, Ampere-Hours Charge, Ampere Rate of Charge, and under the latter, in the same order are the following: Battery No., Put in Car No., Odometer Reading and Condition of Charge. At the foot of the page are noted the number of 750, 1000 and 2000-pound batteries taken out and the total number, the number of each type put in and the total number, and the number of each type and the total number supplied as extras—that is, where the second battery is used in a day.

Next is the Individual Car Record, which is filled each day. Following the date on a sheet ruled for 30 entries, are entered from left to right following data of each machine: Odometer Reading, Miles Per Day, Number of Batteries Used, Time Boosted, Maximum Miles Without Boost or Charging, Total Amperes of Charge, Total Kilowatt-Hours of Charge, Amperes Per Mile, Kilowatt-Hours Per Mile and "Operating Troubles". This record is made of every vehicle in service.

The "Charge in Vehicle" sheet is filled each day and following the date these entries are made: Battery Number, In Car Number, Odometer Reading, Previous Odometer Reading, Miles on Last Battery, Multiply Miles by, Sangamo Meter Set, Total Amperes of Charge, and True Charge Required. In explanation of this sheet statement should be made that multiplying the mileage of the last battery used by a constant for the amperage, that is, 50 miles (if a regular day's work) times eight, this being a safe allowance if the amperage used will average seven a mile, will show 400 amperes, which will be the setting of the Sangamo meter. When the charge is completed the meter will record zero, and as the battery is discharged the meter will show how many amperes have been discharged.

The Day Sheet, which is in reality a summary of every detail, can be made to cover any period desired. It is intended to show in a single line of entries the essential facts of operation. Under the caption "Service Batteries" are the total number in use for the day, and the classification by 750, 1000, 2000 and 4000 pounds capacity; under the captain "Cars" are the total number of vehicles and the number on the road, these being classified by capacities; under "Car Miles and Battery Charges" are the total mileage for the day, the totals made by each classification, the number of battery changes, the maximum distance made with a change of battery, and the total mileage made by the extra or second batteries. Then are noted the total number of batteries charged, the maximum mileage made by any battery, and the total mileage of the batteries used. In addition are entered the number of kilowatt-hours of current used, the readings of the different watt meters, the readings of three main line meters and conditions that may have caused trouble in operation of the machines. When a sheet is completed totals are made of each column and a complete record is found for the period.

The battery operating cost is kept so that the exact expense may be determined at any time, for the day, week, month or any given period. For convenience this is entered on a sheet that will suffice for a month. After specifying the date of purchase and the month, the sheet is divided into five sections, the first of which is for the date, and is filled with printed figures. The second is for charge record, and under this are noted the night charging in the car in ampere-hours, boosting charges in ampere-hours, the maximum rate of boosting amperage, bench charges in ampere-hours, the total ampere-hours of all charges for the day and the total charge in kilowatt-hours. Under the third caption, which deals with mileage, are noted the total mileage, the ampere-hours a mile and the watt-hours a mile. The fourth section covers operating, showing hours of labor, and the quantities of water and soda (caustic potash) used, and the fifth section relates to the cost of power, labor, material and the total expense. When the record sheet is filled for the calendar month the columns are totalled, and below this can be filled the total months, miles, cost, cost a month and cost a mile.

TRUCKS FOR UNITED STATES ARMY.

The remarkable showing of all types of motor vehicles as an adjunct to military movements in the European war has already resulted in orders for commercial vehicles for use in the United States army. While there is no suggestion that the present policy of neutrality will be relaxed in any degree, the equipment of the forces, particularly in regard to transportation, is being brought up to a point of the highest efficiency, which involves, of necessity, the use of many motor vehicles.

NEW PHILADELPHIA ORDINANCE.

A new ordinance that the speed of motor vehicles at all street intersections within the built up section of the city shall not exceed eight miles an hour is being considered by the city council of Philadelphia, Penn.

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MILITARY TESTS OF TRACTORS.

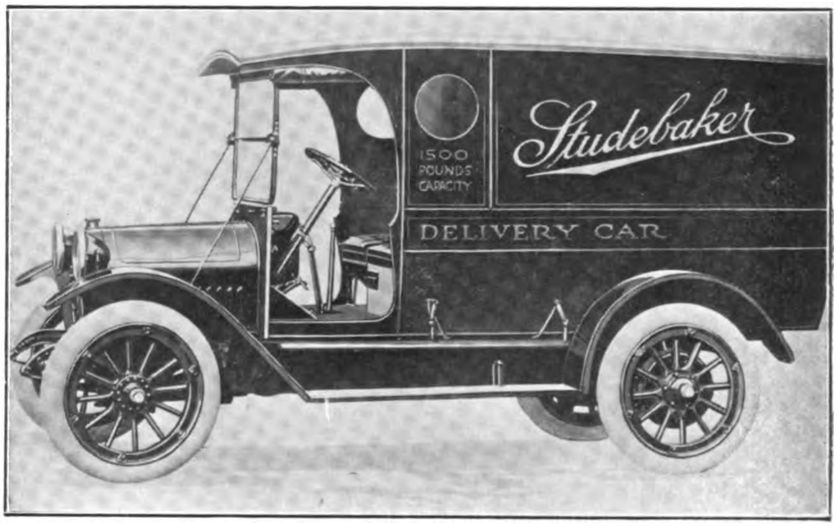
The board of ordnance and fortifications has recommended to the United States war department that a test of military tractors be held in the near future, and it is probable that such a trial will be arranged. An attempt was made along the same line, more than a year ago but, owing to the failure to get a sample machine from France, the effort was abandoned. It is now proposed that American machines be tested under the supervision of the general staff, and it is expected that some valuable and definite results will be attained.

STUDEBAKER 1915 DELIVERY CAR.

The Studebaker Corporation, Detroit, Mich., offers a ¾-ton delivery car for 1915 with a longer base than the previous year, and at a lower price. This machine is especially adapted for the use of merchants who want to meet the demands of competition by swift and economical deliveries.

This car has a carrying capacity of 1500 pounds, and a wheelbase of 108 inches. The latter compares with 106½ for the 1914 model. The motor is a four-cylinder, L head, cast en bloc, with a bore of 3½ inches and a stroke of five, giving it a horsepower rating of 19.60 according to the S. A. E. formula. The valves are located on the left side, and the camshaft drive is helical.

A dual system of ignition is used, the Remy coil and distributor being employed, and the carburetor is a Schebler. The tires, front and rear, are 34 by 4½. The Studebaker delivery car is finished with the best of material, and the workmanship is of high quality. These cars, with a special body design, are likewise being used to great advantage by hotels.



The Latest Studebaker 1500-Pound Delivery Car Which Has a Longer Wheelbase Than the Earlier Model.

A NEW HEWITT ROAD OILER.

The International Motor Company, New York City, has developed a hot penetration oiling truck for the Standard Oil Company, which possesses several new features of interest. The machine is a combination 5½-ton Hewitt truck with a 750-gallon tank, a high-pressure steam boiler and an air compressor. It is stated that hot penetration road oiling is the most rapid, efficient and economical method of applying bituminous binder to a crushed rock road.

CONDEMNS TRUCK OVERLOADS.

With an idea of discouraging the overloading of motor trucks, the commercial vehicle committee of the National Automobile Chamber of Commerce has requested the manufacturers of leaf and supplementary springs to co-operate with the chamber in this work. The attention of truck makers was called to the practise of some owners and dealers in having the spring makers increase the size of the rear springs of trucks in order that loads greatly in excess of the rated capacity of the chassis could be carried.

DELIVERY COMPANY FAILS.

The Public Service Express, Inc., New York City, has filed a creditors' assignment, giving its liabilities as $41,064 and its tangible assets as $22,550. The company proposed to pool the deliveries for department stores, but did not meet with success.

HUNT TRUCK OF STANDARD MAKE.

The C. W. Hunt Company, West New Brighton, Staten Island, N. Y., is offering one standard model of electric industrial truck. This vehicle is a two-ton type, with the same size wheels front and back, an underslung battery beneath the floor and drive from a single motor located back of the rear axle, beneath the frame.

MOTOR 'BUSES GIVE GOOD SERVICE.

Bakersfield, Cal., two-thirds of which is without street car service, is finding a solution of the traffic problem in motor 'buses, which are operated on a seven-minute headway, and at a five-cent fare.

SAXON CARRIES THE MAIL.

A Saxon car in mail service in the Imperial valley, Cal., is covering, in 3½ hours, a route over which the best time for horses was 12 hours.

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NEW LOCOMOBILE TRUCKS.

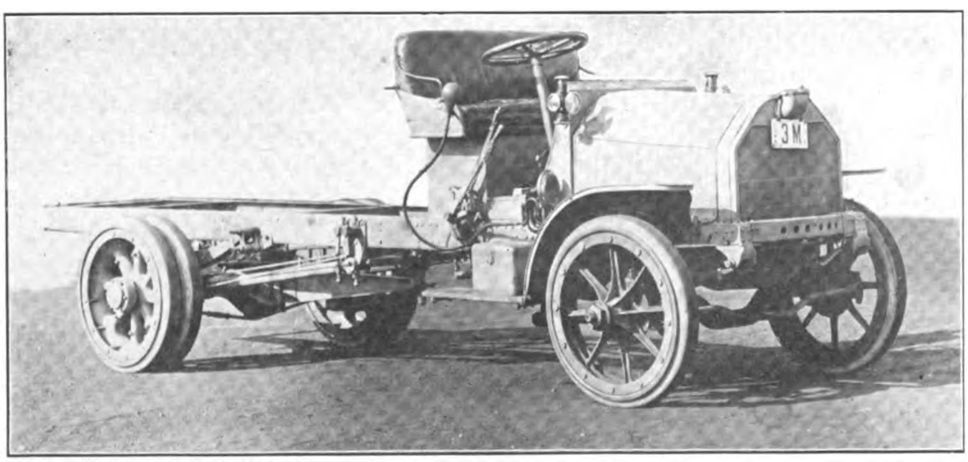
Two Worm-Driven Types of Three and Four-Ton Capacities Will Be Built.

The Locomobile Company of America, Bridgeport, Conn., which has built motor trucks for several years, specializing a single five-ton model only, has made announcement that it will construct three additional sizes. Of these the largest will be a six-ton, which will in design follow closely the original, differing mainly in proportions of components. These two sizes are driven by side chains and sprockets, which are enclosed in chain cases, the chains being carried through a lubricant. In these the driver's cab is located over the engine to insure minimum wheelbase and ease of handling in traffic, with no loss of deck room available for the load.

The new types are three and four tons capacity, there being a single design with somewhat larger components for the four-ton machine. Both have the same power plant, however, and differ in wheelbase length. The design differs from the original in that the motor is mounted under a hood, with the driver's seat behind the dash, and the power is transmitted by shaft, worm and gear wheel to a full floating rear axle, the traction and braking stresses being taken by a heavy radius rod.

The chassis are equipped with a four-cylinder motor with bore of 4½ inches and stroke of six, this giving 28.9 horsepower by the S. A. E. rating, and following the Locomobile practise they have selective gearsets with four forward speed ratios and reverse. The first of these will be ready for early spring delivery. The statement is made that the machines have been tested for two years and have been standardized throughout.

The company is now preparing to concentrate a considerable part of its production in the truck department and, according to its officers, as the demand for high quality trucks has noticeably increased recently, the company is planning to produce from 1200 to 1500, and possibly 1800, at the Bridgeport plant. The company has leased property outside of its present plant which will be fitted for the production of parts and body equipment, including windshields, tops, etc. The company now has 1200 men at work on eight-hour time, and considerable new machinery has been ordered that will materially increase the capacity of the factory when it is installed.



Chassis of the New Model Four-Ton Worm Driven Locomobile Truck, the Larger of Two Types Just Announced.

MOTOR TRUCK CLUB FORMED.

The Motor Truck Club of New Jersey, an association of motor vehicle owners and trade and industrial representatives, was formed at Newark, N. J., Dec. 12, the organization being perfected by the choice of John F. Winchester of the Standard Oil Company of New Jersey as temporary president and L. J. McCracken, manager of the Newark branch of the Packard Motor Car Company, as secretary. The club will for a time hold its meetings at the club house of the New Jersey Automobile and Motor Club.

The purpose of the club is generally to promote the use of motor trucks and to educate the business men to the economic value of such machines. When permanent officers have been elected and a constitution and by-laws adopted the intention is to hold regular meetings, to invite the membership and co-operation of all owners of power wagons, and to have frequent gatherings for the purpose of hearing addresses by transportation and efficiency experts. The club will probably affiliate itself with the Motor Truck Club of America.

WANT BRIDGE LAW REPEALED.

Some of the New Hampshire newspapers are agitating the repeal of the law enacted by the last legislature of that state requiring the towns and cities to strengthen all bridges so that they will safely support 10 tons of moving weight. The bill will become operative April 1, and according to the statements made some of the cities and towns will be required to expend considerable sums. The argument is made that none of the towns and cities petitioned for the statute, and that at the March town meetings the towns, at least, will have to make appropriations to meet the expense. Another contention is that considerable increase of tax rates will be necessary to comply with the law, which, it is maintained, was enacted for the benefit of out-of-state business men who are securing trade at loss to the New Hampshire merchants. Contention is also made that the railroads will lose in freight rates.

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ELECTRIC VEHICLE PRACTISE.

Battery Charging with Equipment Developed for Use with One or Several Machines, with and Without Devices for Automatic Control—Characteristics of the Lincoln Charger and the Wotton Vertical Motor-Generator.

By William W. Scott.

BATTERY charging by the use of motor-generator sets, in which the alternating current is converted into direct current, or a high voltage direct current is converted to a lower voltage current, has generally been referred to as being less economical than conversion of current by rectification, because of the fact that the set having considerable capacity cannot be used efficiently without having what may be termed its approximate load. That is to say, that if adapted for charging several or a number of vehicles, the cost of charging one battery or one vehicle is proportionately much more than were a number charged.

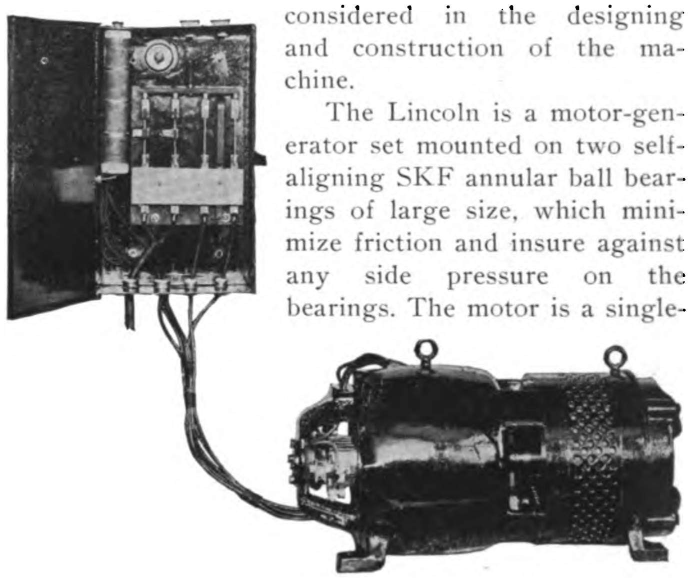
Several concerns are now building motor-generator sets of large capacity that are suited for equipment of charging stations or garages of considerable size, and several others are constructing small sets, or combination machines that are intended for use in the garage where one or two vehicles are kept, and where but little or casual attention is possible.

The mercury arc rectifier, as has been stated, has limitations as to voltage and amperage, and for this reason is built in different sizes for different purposes. In excess of the normal capacity they can be connected in parallel and reactance added, which will afford greater amperage.

Motor-generator sets can also be connected in parallel and two units of different sizes can be used to material advantage. Such equipment, however, is adapted only for conditions where considerable capacity is necessary. In small garages where a single vehicle is to be charged, either a pleasure car or a service wagon, motor-generator sets that will do the charging at approximately the normal rate, are practical equipment.

That which is designed for equipment of private garages where a single pleasure car is kept is built by the Lincoln Electric Company, Cleveland, O., and this machine has specially interesting qualities and characteristics. It is known as the Lincoln Charger, and the theory of operation is that charging is begun at a given amperage and continued, unless conditions entail a change of operation, from 12 to 14 hours, the amperage being reduced as the voltage of the battery rises, the charge being automatically "tapered off", which insures a full charge. Not only this, the claim is made that the charger will, if charging is continued from 12 to 14 hours, give a slow over-charge that will effectually reduce sulphation and bring the battery to high efficiency without excessive gassing.

The apparatus is exceedingly simple, and is especially interesting because of the method of control. The charge in itself is essentially a motor-generator, and it is operated by a starting or switch box that is located wherever convenient, but can be placed on a wall, where it may be easily reached and yet be out of the way. Battery voltage is dependent upon the age, the condition of the plates as regards sulphate (when lead-acid cells are used) specific gravity of the electrolyte, fluctuations of the current voltage, as well as possible short circuits. These are variables that have material bearing on charging, but must all be considered in the designing and construction of the machine.



The Lincoln Charger, Designed for Single-Battery Charging, with Practically Constant Potential, with the Control or Switch Box.

The Lincoln is a motor-generator set mounted on two self-aligning SKF annular ball bearings of large size, which minimize friction and insure against any side pressure on the bearings. The motor is a single-phase, non-starting induction motor with a very low resistance squirrel cage winding. The generator is a two-polar type, compound wound, with a characteristic that approaches as closely as is possible, for the size of the machine and work to be done, a constant voltage generator. The set is operated at 1800 revolutions a minute for 60-cycle current supply, and 1500 revolutions for a 25-cycle current. The machine is very compact and light of weight, having been designed particularly for efficiency and power factor, both of these characteristics being unusually high for the size of the set. These are usually built to charge batteries of from 38 to 44 cells, but are specially built to meet

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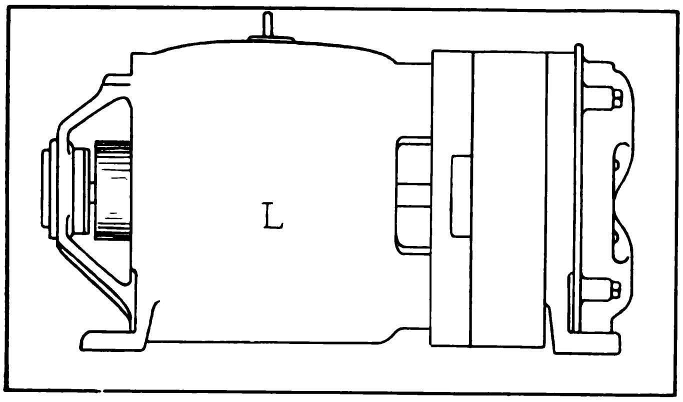


Outline Sketch of the Lincoln Charger, Which Is Mounted in a Frame or Housing.

other requirements. Each machine is a separate charging unit.

The control of the charger is by a steel cabinet or switch box that is wired to it, and in this is mounted a standard knife switch with a number of special jaws that are so arranged that the closing of the switch causes a series of changes. The series of diagrams are desirable for reference in the description of the control, and one of these shows the set in outline. The machine is sufficiently enclosed as to insure protection from contact and the frame is supported by four feet—one at each corner of the base. In service the set need not be bolted down, but it must be placed level.

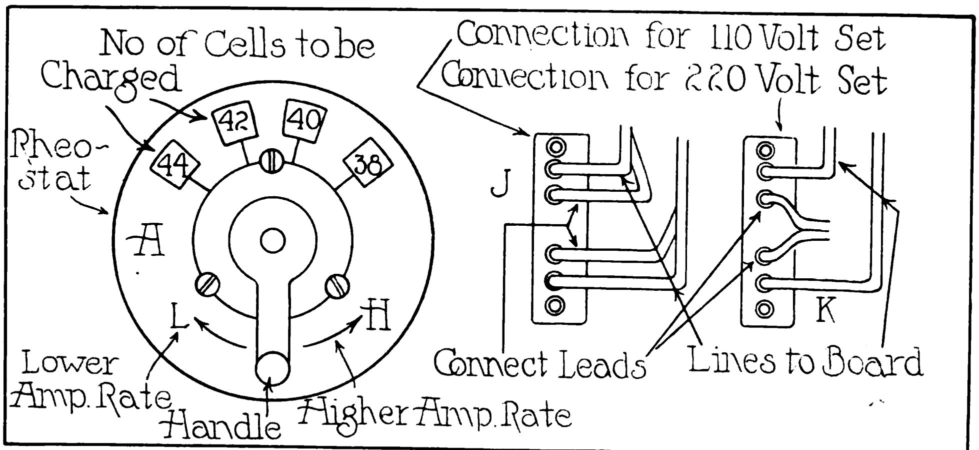
Noting the front and side diagrams of the switchboard, in the front view the switch is closed, and in the side view it is shown open. The switch is a four-pole knife type and from the base of the switch the wiring leads extend. The two centre leads of cable are for connection with the battery through the charging receptacle, and the two outside leads are connections from the motor-generator through the board itself. Between the board connections and the base of the switch are four fuses. These are designated E and F, there being two of each designation, E being the direct current fuses and F for the alternating current.

Referring to the same sketch one will note that the jaws with which the blades of the switch contact are six in number, there being two each for the two centre blades of the switch and one for each outside blade. Reading from left to right the two lowest contacts for the centre blades are numbered 1 and 4, and the second series of contacts are 5, 2, 3 and 6 respectively. As the switch is closed the contacts of the blades are first made with jaws 1 and 4, next with 3, and last with jaws 5, 2 and 6. In other words, the jaws are made of different lengths, as will be seen by reference to the side sketch of the switchboard, and as the switch blades are moved upward these are brought into contact with 1 and 4 simultaneously, then 3, and finally 5, 2 and 6, but as the connection is made in the last or third step, it is broken with jaw 1, so that the first result is discontinued when the charge is in operation.

The closing of the circuit by the contact of the switch blades with 1 and 4 closes the battery across the shunt field of the direct current generator and excites the field fully. When contact is made of the switch blade with jaw 3 the series field is short-circuited and closes the armature circuit across the battery. This causes the generator to start as a motor with current supplied by the battery and the set will then run to practically synchronous speed. As further contacts are made with jaws 5, 2 and 6, the leads from the motor to the alternating current supply are closed and single-phase induction motor starts to charge, and as the contact with jaw 1 is broken the short circuit on the series field is opened, so that the generator becomes a compound wound interpolar machine.

The explanation may appear lengthy in view of the fact that the operation consists of merely moving the four-blade switch from the "open" position to fully "closed" with a stop when each of the three successive steps or stages are completed. That is that when jaws 1 and 4 are engaged the upward movement of the switch is stayed and after awaiting a period sufficient to count five slowly the switch is again moved upward until jaw 3 is engaged. After a second count of five the third advance is made, and the switch is fully closed and the charger is in operation.

The front view sketch of the switch box shows the switch closed, the handle of the switch being indicated as C. In this sketch the rheostat is shown at A, the alternating current connection as B, the switch box as H, with the cable leads to the charging plug. Between the base of the switch and the wiring connections the fuses E and F are installed, the two in the centre being designated E, and these have 40 amperes capacity. The fuses are protected by a fibre cover. Fuses F are rated at 30 amperes, with 220 volts line voltage, or 60 amperes with the line voltage 110 volts. When sent from the factory the charger is connected for 220 volts line voltage, when the wiring is connect-



The Rheostatic Control of the Lincoln Charger, Which May Be Adapted to Several Sizes of Battery, and Sketches of the Wiring Connections.

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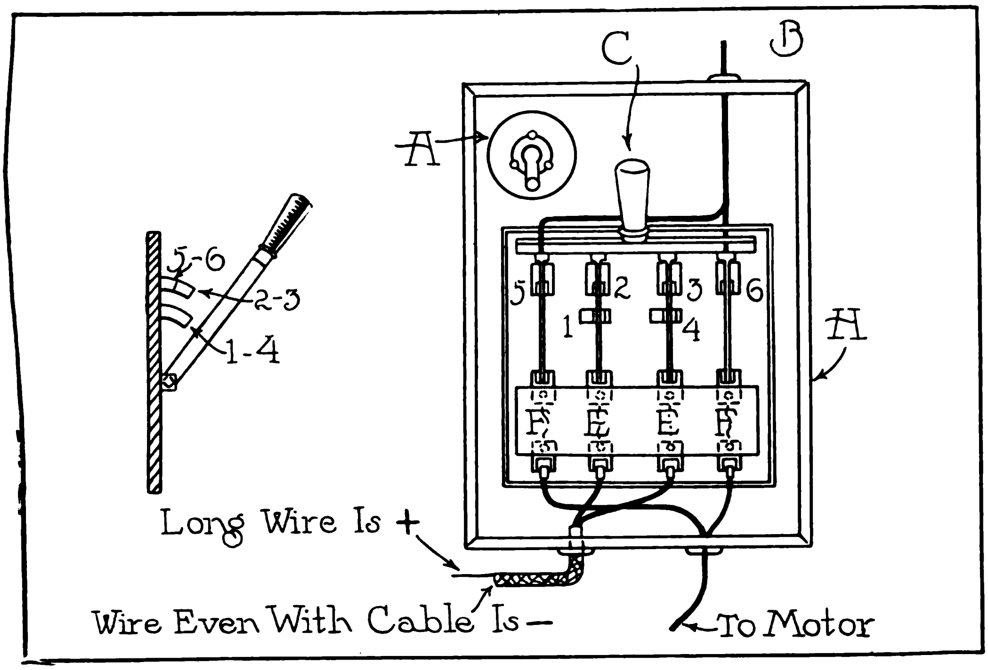


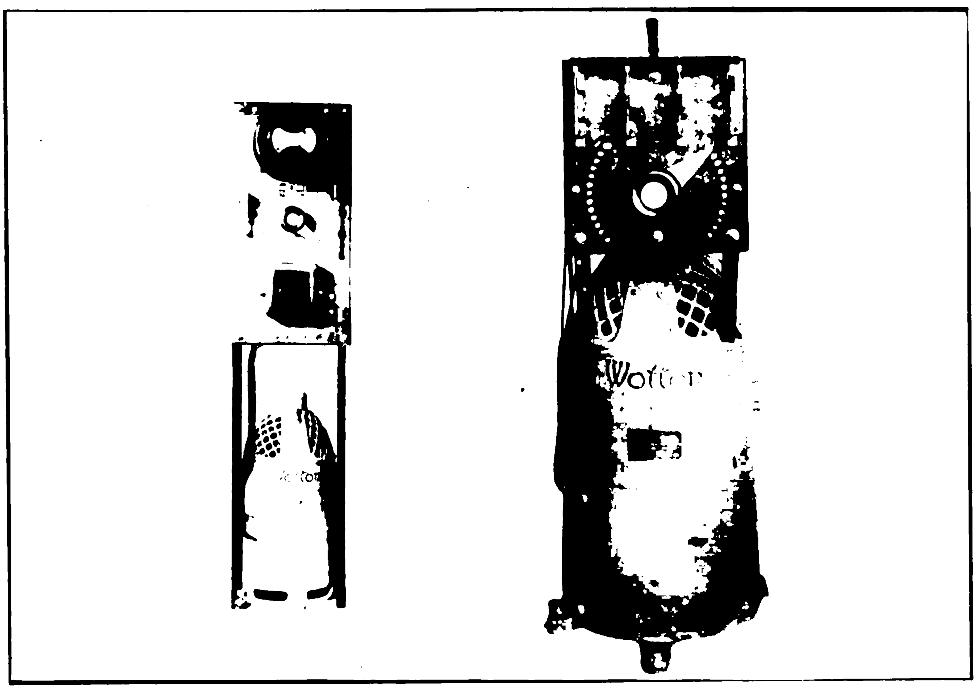
Sketch Showing the Side and the Front of the Four-Blade Switch of the Lincoln Charger, by Which the Various Changes for Starting Are Accomplished.

ed. as is shown in sketch K, but if the voltage is 110 volts then it should be connected as is indicated in sketch J.

The characteristics of the charger are that because of the special construction of the magnetic circuit and the arrangement of the compound wiring, the starting rate is up to the maximum capacity, on a totally discharged battery. As the charge is continued the counter electromotive force of the battery rises, this decreasing the charging rate. After the expiration of the first hour of charging the rate becomes practically constant, and the greater part of the charge is made at what is approximately 1½ amperes a plate. Or, to state it another way, with a 13-plate cell battery the greater part of the charge will be from 20 to 17 amperes, this indicating a gradual diminution of the charge. But when the battery is 85 per cent. charged the amperage will quickly decrease as the battery voltage rises, and when the cells are fully charged the amperage will fall to about a half ampere a plate, or approximately six amperes for the 13-plate cell battery. If the charge is longer continued the amperage will continue at the half-ampere rate until the current is cut off by the opening of the switch.

With the rheostat, which is in the shunt field, the amperage can be varied from high to low, according to what is required, this variance of from three to seven amperes for the finishing rate being obtained by swinging the rheostat handle to the right for higher rate, or to the left for the lower rate. On the sketch the movement of the rheostat handle and the results are plainly indicated. The full charge requires about 12 hours, but should there be continuance of the charge for even several hours more than that period, the only result would be an overcharge at a very low rate that would have a general effect of reducing any sulphation of the plates. The claim is made that when the charger is adjusted the correct charging rate will be obtained, no matter whether the battery is wholly or partly exhausted. This is due to the fact that it is what is practically a constant potential system of charging, and the amount of current flowing through the battery is dependent upon the voltage of the battery, or rather upon the difference between the constant voltage of the supply line and the voltage of the battery.

The rheostat can be set for any combination of cells as, for instance, 30 to 36, the number being increased two for each setting, or from 38 to 44, as illustrated, but this is the extreme range, and for two batteries, the one of 34 and the other of 42 cells, two



At Left, Wotton Motor-Generator Set (A) with Automatic Control, Adapted for Charging a Single Vehicle; at Right, a Similar Machine (B) Without the Controlling Devices.

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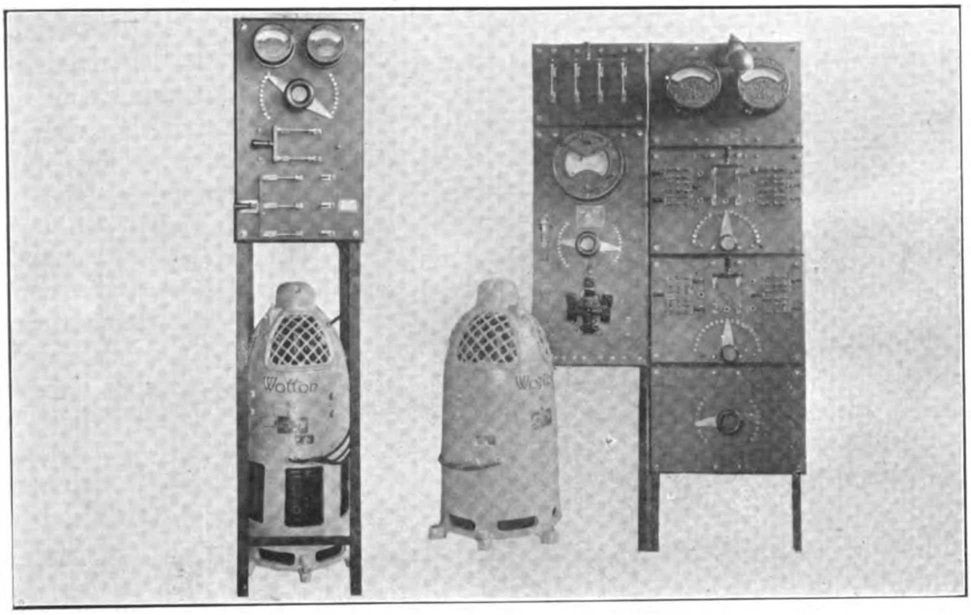
chargers would be necessary. The machine requires practically no attention after being set to charge a specific battery, aside from greasing the bearings at periods that may be as infrequent as once a year, and renewing the brushes should they become worn. The design of the charger is such that in the event of short circuit, open circuit, ground circuit or failure of the line voltage no damage can result, and the machine really cares for itself automatically. Should the alternating current supply fail while the charger is in service, the machine will continue to run, with the generator as a direct current motor. As about one ampere of current is required to drive the charger without a load, the loss of current from the battery is extremely small, and the current used can be restored to the battery in a very short time. Should the current fail for a time the charger will run as has been stated with current supplied from the battery, but with the restoration of the current supply the machine will resume charging as soon as it has reached the necessary speed. In making the connection of the charging plug with the cable, when installing an outfit, no mistake can be made, for the construction is such that no matter how attached the series field will be rightly connected.



At Left, a Non-Automatic Wotton Motor-Generator (C), Adapted for One Large or Two Small Vehicles; at Right, a Garage Outfit (D), Designed for Boosting and for Charging Small Batteries.

An illustration is shown of the charger and cabinet, this being the entire outfit, but in the cabinet a tubular resistance may be noted, which is not used in the latest cabinets, the small rheostat shown in the sketches being much more satisfactory.

The Lincoln charger is for use in the garage where a single vehicle is kept, or one machine may be installed for each car, or wagon or truck, and where there is sufficient time to utilize a method that is practically charging at a rate so slow that gassing is at least minimized, if not prevented.

The Electric Products Company, Cleveland, O., which manufactures automatic rectifiers, automatic rheostats and automatic cut-off panels and constant current rheostats and garage charging panels, builds a motor-generator of a vertical type that is used in various combinations. A series of these machines and the controlling instruments are shown in an accompanying illustration, these being of different types and sizes and, with the controlling devices, adapted to differing uses.

Considering these, that designated as A is a motor-generator set with a charging panel suited for installation in a private garage, where practically no attention is given. Where a direct current is supplied merely the panel is required, but with alternating current the set shown is used, the vertical motor-generator being covered with a protecting ventilated casing, which supports the panel. This machine is generally used with an automatic cut-off that terminates the charge at the expiration of a given period, and to come within the allowable time limits for charging, from eight to 10 hours, the rate of charge can be adjusted to give a very steep taper for lead batteries, or a very close approximation to constant current for Edison batteries. This taper is ordinarily adjusted from 175 per cent. of the normal charging rate at the start to 25 per cent. at the finish to practically prevent gassing.

The motor-generator can be used with advantage on lines where the voltage fluctuates considerably, the ampere rate of charge being determined by the degree of field excitation and the speed of the generator. If the line voltage varies greatly the excitation is unchanged, and the only difference in speed is the slightly varying slip of the motor. A rise or fall of 10 degrees in the line voltage will not change the charging rate perceptibly.

Further considering the types of machines, that designated as B is non-automatic and is designed for use in a private garage for the charging of a small wagon battery, and that specified as C is a larger size that will serve one large truck or two small wagons. This size, however, is more desirable and does more efficient work when equipped with an automatic cut-off, automatic restarting and the automatic "soaking" or over-charging device, which is known as the "Soakometer". At D is illustrated an equipment suited for garages that afford service to both gasoline and electric vehicles, and this apparatus is a combination that will charge both vehicle and ignition and lighting batteries.

The simplicity of these vertical motor-generators, the fact that they can be operated with practically no

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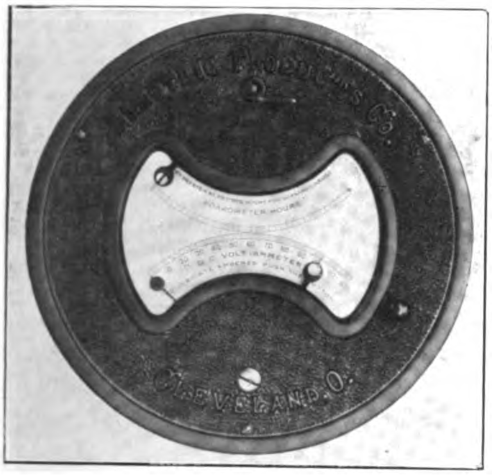
attention in small garages, and with minimum attendance in stations of even considerable size, the small space required, and that they can be arranged in combinations to obtain practically any desirable results, are all factors of material importance that should be considered by those who have small equipments and seek to obtain satisfactory and economical service and as high efficiency as is possible.



The Soakometer, an Instrument Designed for Automatically Controlling Over or Soaking Charging.

In connection with the motor-generators specified the "Soakometer" is used with excellent results. This instrument has two separate movements contained in a case that is attached to the switchboard or panel. The upper movement is a time measuring clock and below this is a combination volt-ammeter. When in use dead or set pointer of the volt-ammeter is set at the battery finishing voltage, and when the charge has been completed this pointer engages with the indicating voltmeter pointer, this closing the relay electrically and opening the charging circuit.

The clock movement may be set to function in either of two ways, the first of which delays the cutting off of the charge for any desired time so that the battery may be overcharged, and the other is to delay the time for beginning the charge, so that the charging may be done during the "off-peak" period and at a lower rate. For the private commercial garage the instrument will provide for giving the weekly overcharge for lead-acid batteries, saving the expense of attendance, and will insure that this attention is given. The "Soakometer" charge can be set for any period shown by the indicating scale, and the charge continued for that period in addition to the normal charge, which is indicated by the increase of voltage.

The motor-generators referred to are small type and should not be confused with the larger sets that are used for supplying practically any demand, which are frequently of such size that a considerable number of vehicles may be charged at one time. These are necessarily confined to a charging voltage that will provide not more than 2.6 volts a cell, but the amperage may be very high, 500 or more, this being necessary when heavy boosting charges for Edison batteries are required for brief periods. Normal operation does not require heavy charging amperage, but it is essential for boosting in most service wagon garages.

(To Be Continued.)

PREFERS 1½-TON TRUCKS.

In the annual report of the quartermaster-general of the United States army, one and 1½-ton trucks and trailers have been given official indorsement. The report contains the details of expenditures for gasoline, lists of trucks purchased and of those in service. Purchases of 30 trucks are listed, costing a total of $73,675, and used at 17 different posts throughout the United States and territories. All but three of these are of 1½-ton capacity, these being one five-ton and two two-tons. Some interesting information on cost is given in the report as follows:

Motor Trucks in United States and Hawaii.

Total number reported	33
Total cost for fiscal year	$34,273.74
Total mileage	195,327
Tons hauled one mile	209,408
Average cost per vehicle, per year	$1,038.59
Average miles per year, per vehicle	5,919
Average tons hauled one mile, per vehicle	6,345
Average cost per ton per mile	$.2213

Of a total of 61 trucks on hand, reports on 35 in actual service are given. These 35, except in four instances, are not included with the 30 purchased during the fiscal year, so that of the total 61, every one has seen active service, only two of which have been laid up a part of the year.

STORAGE OF OIL MAY BE FORBIDDEN.

An ordinance prohibiting the storage of inflammable oils within the city limits is being considered by the city council of Chicago, Ill. It would affect not only garages and supply stations, but also those large users of trucks who have adequate storage facilities of their own.

NEW CALIFORNIA 'BUS LINE.

A motor 'bus line has been started by the Sonoma County Transportation Company, which will make two trips daily between Napa and Santa Rosa, Cal.

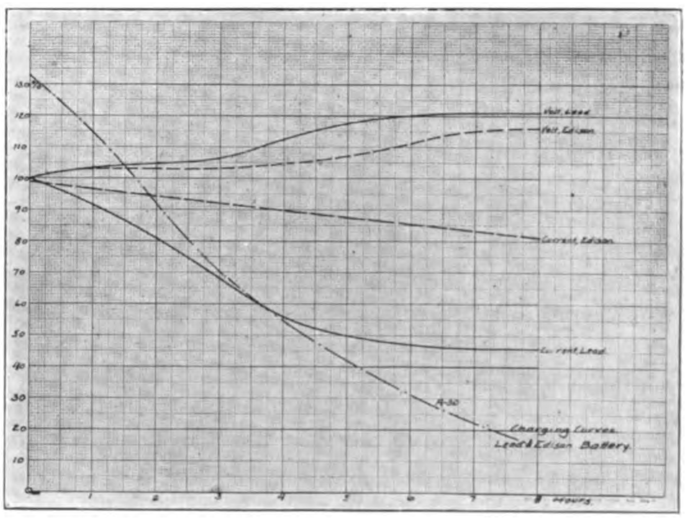


Chart Showing the Possibilities of Adjustment of the Wotton Charging Outfits, to Afford the Steep, Tapering Charge for the Lead-Acid Battery, or the Approximate Constant Current for Edison Cells.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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ADVERTISING RATES.
Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

UNIFORMITY OF COST RECORDS.

Uniformity of operating cost records has been advocated by associations and clubs engaged in the promotion of the use of motor vehicles for freight carrying, and emphasis has been laid upon the possibilities for economy that will follow attention to material factors, many of which are neglected or lost sight of by owners who assume that accurate knowledge of the work done and the cost can be obtained from the inadequate accounting generally the vogue with animal equipment. Because of the demand for transportation cost and the very unsatisfactory data ordinarily available, some business men believe that the suggestion made to have careful record of their vehicles is more for the purpose of benefiting others than themselves, and for this reason they hesitate to obtain facts and figures that they would find invaluable were they to use them. Large concerns, that have comprehensive systems of house accounting, usually adapt these to include the motor equipment, and no good purpose would be served were they to change. Yet those who know detail can work out economies that would not otherwise be possible or practicable.

WHAT DELIVERY REALLY MEANS.

The stores that deliver the purchases of customers price all the goods sold so as to cover the cost, although the proportion of the business that must be delivered is well known. This is in part due to the uncertainty of delivery, that is, the expense of delivering comparatively inexpensive goods will be more than that of costly purchases. In other words the cost of delivering to a customer a package worth $100 may not be as much as that of delivering a parcel valued at 50 cents. So expense must be averaged rather than charged specifically. Many stores that do not deliver goods sell slightly cheaper than those that make delivery. Because of the desire to afford all customers the same consideration, largely from the fact that value of purchases will from time to time widely vary, delivery is regarded as a uniform service, no matter whether the article be a two-cent lamp wick or a $1000 piano. Were delivery added to the actual cost of the goods, there is no doubt that a greater part of what is now delivered would be taken away by the purchasers because of the seemingly heavy charges that would necessarily be exacted for small values, and those who purchased articles of large cost would find the expense of delivering but a trifling part of the price.

FOREIGN TRUCK SALES.

The motor truck industry has sold, if statements made are based on fact, and there is reason to believe the stated numbers are not excessive, several thousand machines to England, France and Russia, which will be used for transportation in war operations. The manufacturers of England and France have been unable to supply the demand, for their plants have been developed on normal requirements. The probabilities are that buying will continue until a cessation of hostilities, and in addition to the completed machines large numbers of parts will be required for repair.

These machines have been ordered from concerns having large facilities and resources—those that might, if not kept busy with these rush orders, exploit the markets of the neutral countries. But with the unusual opportunities for selling and minimizing the expense of marketing, the firms have turned to what will yield the greatest profits. The possibilities of the neutral foreign markets are not being developed by the smaller concerns, despite the apparently general desire for such exploitation.

MOTOR TRUCK SHOWS.

No exclusive motor truck shows are to be held the present year, although a considerable number of exhibitions will be of both pleasure and service vehicles. The experience of manufacturers and agents, who paid large prices for the use of elaborate decorations, for the accompaniment of music and ostentation, was that such expense was not justified when the revenue was simply from those who were actually interested in machines. There is reason to believe that in the large commercial centres shows of wagons and trucks, separate from and preferably at another time than the pleasure vehicle displays, would be very profitable. The average business man is not inclined to encourage truck shows as social events, but he is deeply concerned in efficient highway transportation.

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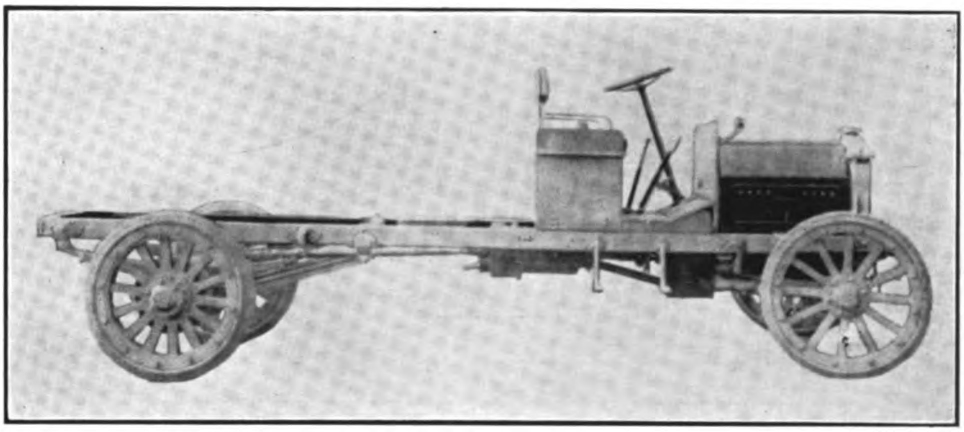
WORM DRIVEN FEDERAL 3000-POUND TRUCK.

MAINTAINING its policy to produce a single size of vehicle, the Federal Motor Truck Company, Detroit, Mich., has broadened its market largely by developing a worm and gear wheel driven machine, which is now ready for delivery. The Federal Company has since its formation specialized one type, this being a wagon of 3000 pounds capacity, because of the belief that concentration and eventual development would be far better than experimentation.

Since the first Federal vehicle was built the purpose of the company has been to exploit the field that appeared most productive, and the size was determined because of the belief that this would be the most useful and generally utilized unit. That is, a vehicle of 3000 pounds capacity could be best used to advantage by those requiring transportation equipment, and that, all things considered, this would be the machine that would be the popular size.

The success of the Federal Motor Truck Company has been pronounced. Its selling organization has been carefully developed, and besides a very large domestic market it has made foreign connections, so that it was doing an unusually satisfactory export trade prior to the European war. The original Federal truck was standardized from a manufacturing point of view, but it was perfected and simplified until it was regarded as being a thoroughly balanced machine.



Side View of the Chassis of the Federal Worm Driven 3000-Pound Truck, Production of Which Has Been Begun.

The Federal Motor Truck Company has always been progressive and has been particularly successful in unifying the endeavors of its sales representatives, it being probably the only concern whose agents and branch managers have an organization that is devoted to the stimulation of co-operation and to standardized service for the owners. This association, in the East, has close affiliation, and what amounts to an exchange of attention in the event of the use of a machine in the territory of an agent other than he from whom service is expected.

With a desire to reach all the market for 3000-pound machines within the range of its selling force, and to meet with the demands of those who require noiseless operation, the company nearly a year ago began experiment with worm and gear wheel drive, for the purpose of adapting this, so far as practical, to the standard Federal chassis. There was no reason to sacrifice what had been established as being satisfactory design and enduring construction, and to include all that had been proven and to make such changes as would insure equal success with the worm drive was the real object which was sought by the company.

The adaptation of the worm and gear wheel drive meant the change of the rear axle, power transmission system, rear springs, chassis frame and method of braking, so it will be understood that careful engineering was necessary to insure the strength and endurance, to minimize the weight, and to maintain the other qualities that are characteristic of the chain driven type. The development and experimentation extended over practically a year before the engineers believed they had met with all conditions that might arise, and that manufacturing could be begun. The announcement of the worm drive type was not made until within a month, and the factory is now producing these machines in numbers to meet the demand. The chain driven machine will be continued without change of any kind.

The new vehicle is equipped with a Timken-David Brown type of rear axle, and the claim is made that this construction insures silence, cleanliness and long life, three decidedly important factors. For patrol and ambulance work, public passenger service, undertaker's wagons, hotel 'buses, or where noise would be objectionable, the worm and gear wheel drive is especially desirable.

The weight of the completed chassis is 4000 pounds, but 150 pounds more than the chain driven type, and the construction is such that no element of strength or endurance has been sacrificed. The motor is rated at 30 horsepower, which is adequate in all operating conditions. The engine is a four-cylinder, four-cycle, water cooled, L head type, with bore of 4⅛ inches and stroke of 5¼ inches, having an S. A. E. rating of 27.25 horsepower, but it will develop considerably in excess of these figures.

The cylinders are cast en bloc with water jackets integral, and with an open head that is covered with a plate carrying the water outlet manifold. The valves are at the left side of the motor and are fully enclosed. The intake and exhaust manifolds are at the left side, the engine being clear save for the oil gauge and the

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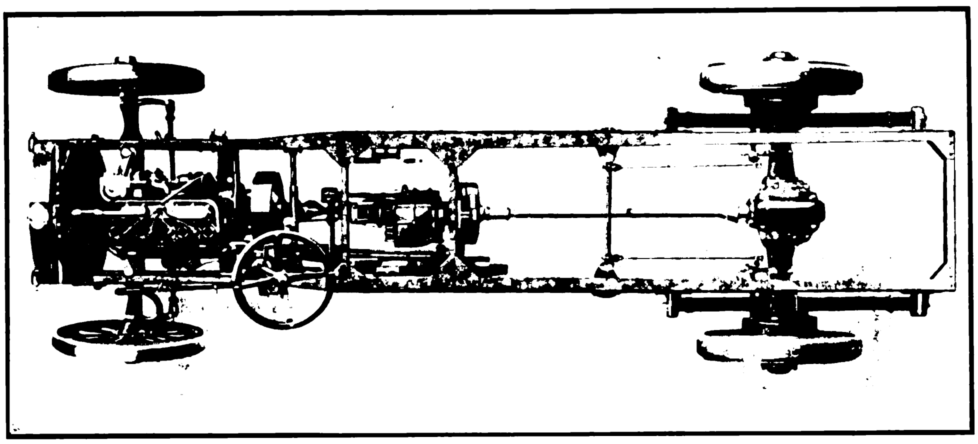
governor connection with the intake above the carburetor. The water pump, magneto and governor are at the right side, and these are all driven by an outside shaft on which is a pinion that meshes with the timing gear.

The crank case is an aluminum alloy that is cast with the base forming the oil reservoir. The upper section of the crank case carries the main bearings, which are three in number, the bronze journals being lined with special babbitt metal. The crankshaft and the camshaft are of large size, carefully heat treated, with bearings of unusual diameter and length. The pistons are carefully fitted and balanced. The connecting rod big ends are fitted with babbitt bearings and the small ends are bronze bushed for the wristpins, the pins being stationary in the piston bosses.

The valves are large and the operating mechanism is constructed with abundant means for adjustment. The motor is cooled by a circulation of water forced by a centrifugal pump, through a large radiator having a cellular centre section, that is bolted to sturdy top and bottom tanks. Radiation is promoted by a belt driven fan. The radiator construction is such that repair or replacement can easily be made. The ignition is by a water proof Eisemann high-tension magneto with a set spark. The fuel is supplied through an automatic float feed type of carburetor, with central jet, that is claimed will afford a satisfactory mixture in all conditions of operation. The gas control is by foot accelerator only, there being no hand levers for the driver to manipulate. The lubrication is by a combination system in which a constant level for splash distribution is maintained by a plunger pump, this insuring a certain circulation of the lubricant and an adequate supply for all parts of the motor in frictional contact. The motor is mounted in the chassis frame on three points, and the radiator is spring suspended, so that these are not affected by chassis distortion.

The clutch is a pressed steel cone 16 inches diameter, that is fitted with six springs under the leather facing, this insuring easy engagement and preventing the stresses from "crabbing". The forward end of the clutch shaft is carried on self-lubricating bushings when free, and the "throw-out" is so constructed that there is no thrust or wear on the rollers, save when the clutch is actually clear of engagement. The gearset is mounted between two heavy frame cross members, and it is coupled to the clutch shaft by a universal joint that compensates for all chassis stresses. The gearset is a selective type with three forward speed ratios and reverse, and is constructed with shafts and gears of heat treated nickel steel, which are mounted on high duty roller bearings.

Directly back of the rear frame member, supporting the gearset, is the service brake, which is mounted on the driving shaft. The drum is 10 inches diameter and the shoe contracts on the wide face. Between the service brake and the rear axle the large driving shaft is carried on two universal joints of the cross pin type that are completely encased and packed with grease. The rear axle is a full floating construction, with a centre and two end sections that are bolted together. The centre part of the axle carries the gear wheel and differential mounted on Timken roller bearings, and the cover plate is the mount for the worm and the thrust and radial bearings. The splined ends of the driving axles are fitted into the differential assembly, and the outer ends have integral flanges that are bolted to wheel hub flanges. The wheels are carried on large roller bearings in the ends of the axle housing. The axle shafts are chrome nickel steel, carefully heat treated. The end sections of the axle housing have the spring seats cast integral with them, and brake flanges are solidly mounted, with the inner ends of the brake shafts carried on brackets bolted to the housing.



Plan View of the Chassis of the Federal Worm Driven 3000-Pound Truck, Showing the Suspension of the Gearset and the Location of the Service Brake.

The frame is a heavy pressed steel channel section with the webs tapered from the centre to the ends, and it is slightly "necked" at the forward end to insure a short turning radius. The frame is heavily gusseted and reinforced. The frame is suspended on semi-elliptic springs, the rear set being 54 inches length and three inches width, that are practically straight when carrying a capacity load. The springs are shackled at either end, and the driving thrust and braking stresses are taken by the I section radius rods that extend from the axle housing to the frame side members, these being pivoted to eliminate the strains from chassis "weaving".

The front axle is an I section, and is fitted with roller bearings. The wheels are of wood, 36 inches diameter, shod with 3½-inch tires in front and five-inch tires at the rear. The standard wheelbase is 120 inches, or 140 inches, the purchaser having a choice. The steering gear is heavy, with the tie bar carried behind the front axle to protect it against contact with

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road obstructions. The 18-inch steering wheel is at the left side, and the control is extremely simple, there being no levers on the wheel, the clutch and service brake pedals, accelerator pedal and the gear shifting and emergency brake levers being all the driver has to give attention to.

The emergency brake drums on the rear wheels are 16 inches diameter and three inches width, and the brake shoes are faced with Raybestos. The means of adjusting the brakes are very simple and accurate, and adjustment can be made with a minimum of labor.

The motor speed is controlled by a centrifugal governor and with a maximum of 1190 revolutions a minute the machine will make 15 miles an hour. Extreme care has been taken to insure adequate lubrication of all moving parts and wick fed oil insures a sufficient flow wherever necessary. The oil cups are of liberal size and only require occasional filling.

The chassis can be fitted with any of the Federal standard stock bodies, these having loading space of 102 and 126 inches behind the driver's seat, according to the length of the machine.

THE MOTOR TRUCK ON THE FARM.

For the farmer supplying the city market with fresh vegetables and other perishable products, the motor truck offers an important means of solving the problem of transportation. Train schedules are not at all certain to be favorable for this purpose, and the use of horse drawn vehicles necessitates a location on the more expensive land near the city. Even if the train service can be used, the additional handling involved results in greater loss and deterioration and, for the purely perishable specialties, is seldom satisfactory. The motor truck, on the other hand, affords the rapid transportation of large loads, with only one handling at the beginning and end of the journey and, in the cost of operation alone, will doubtless be found much more economical than either of the other methods. Because of the long distances which may be travelled, the farmer is able to locate on cheaper, but often better, land somewhat remote from his market, yet without sacrifice of his facilities for reaching it. Some comparisons reported from the vicinity of Philadelphia are enlightening and of interest, as illustrating the showing which the truck has made, operating under exactly the same conditions as the horse drawn vehicles with which it is compared. Buying land 26 miles from Camden, N. J., and seven from the nearest railroad station, because the price asked was $40 an acre instead of $150, at which nearer tracts were held, a farmer attempted to reach the Philadelphia market with a two-horse team. Starting at 3 o'clock in the afternoon, Camden was reached at midnight and, by the time the round trip by ferry to Philadelphia was made, with an allowance for unloading, it was 1:30 or later in the morning before Camden was reached on the return trip. Resting the horses and men for a few hours, the start was made at 4 o'clock in the morning and home was reached at noon, with the whole crew in an exhausted condition. A motor truck was secured and the whole trip was made in five or six hours, three round trips having been taken in 16 hours during a particularly busy season, the loads totalling nearly 13,000 pounds. Another farmer, similarly situated, finds that he can make three trips with his truck, while a horse team makes one, and that on each he carries three times as much as would be possible by wagon.

These are but a few of many examples which show conclusively how great is the field for the commercial vehicle in agricultural service alone.

CAR OWNERS PAY WAR TAX.

Car owners in many states have been notified that special taxes under the new revenue law must be paid by them, and each applicant for registration is required to affix or pay for a 10-cent revenue stamp on his application. This applies to commercial as well as to pleasure vehicles, and chauffeurs must also pay a similar fee.

A TRUCK DEMONSTRATION.

In a recently reported demonstration of a Peerless truck at Danvers, Mass., a load was taken at the town sand pit, a run of 3.2 miles was made, six square yards of gravel spread, and the return to the pit made in a total time of 55 minutes. A similar run of 2.2 miles was made in 45 minutes for the round trip, including the time taken for spreading the gravel.

TORBENSEN AXLE FOR FREMONT-MAIS.

The Torbensen Gear and Axle Company, Newark, N. J., has licensed the Lauth-Juergens Motor Car Company, Fremont, O., to manufacture internal gear drive axles for use in the 1½-ton Fremont-Mais truck. The Torbensen patents, which cover the internal drive for rear axles very broadly, are dated March 18, 1902, and July 16, 1902.

SAFETY LAWS TO BE ENFORCED.

Mayor Good of Cambridge, Mass., is to enforce the safety laws in that city, in an effort to reduce the number of accidents. Spaces six feet wide on each side of the trolley tracks are to be marked with safety posts with chains stretched between them, barring vehicles from the zones so established.

The Standard Motor Truck Company, Detroit, Mich., has appointed E. B. Finch general sales manager. He will also assist the president of the company. Mr. Finch has spent 14 years in the automobile industry, connected in executive capacities with the Packard and Chalmers companies.

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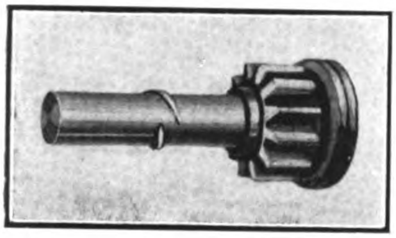
STARTING MOTOR FOR COMMERCIAL VEHICLES.

A STARTING motor, which is interesting as much from its simplicity as from the very original means of automatic engagement and release which are employed, is the Brolt, marketed by Brown Brothers, London, England. The motor drives through a pinion meshing with a gear ring on the engine flywheel. This pinion, with its shaft, is cut from solid steel, and slides into the armature shaft, which is hollow and threaded internally with a quick pitch thread. On the pinion shaft are two keys so shaped as to engage the interior threads, the effect of the rotation, therefore, being to move the shaft in or out of the armature spindle, the teeth of the pinion meshing with the flywheel gear, when screwed inward to the end of the bore, but out of mesh when screwed outward to the permitted limit of travel. The pinion being thus out of engagement, the motor is started by a simple foot switch, and the armature spindle carrying the pinion shaft begins to revolve. The pinion, however, lags and thus there is a rotation between the interior threads and the spiral keys, which has the effect of moving the pinion shaft inward and the gears into mesh. The motion of the pinion and shaft, up to this point, is horizontal, but, when the latter has reached the end of the bore, it necessarily begins to rotate with the armature, carrying with it the flywheel, and starting the engine. The switch is now thrown off, and the revolution of the flywheel immediately rotates the pinion shaft in the spindle, withdrawing it and throwing the gears out of mesh. Even if the switch should not be touched, the engine would soon overrun the motor, with the same effect. Should the switch be closed by accident while the car is running, the inward movement of the pinion shaft is overcome by a small friction wheel fixed on the outer end of the pinion gear, and lightly touching the flat peripheral surface of the flywheel, sufficient rotation being given by this contact to keep the pinion out of engagement. It will be seen that, without complicated mechanical or electrical devices of any sort, the starting, meshing and release of the motor gear are controlled by a single switch, and the system is so nearly automatic that there is no possibility of damage from careless operation. Moreover, this simplicity permits a low price, and the minimum of trouble and expense in installation.



Brolt Motor Starter Pinion.

DE DION'S 1915 MODELS.

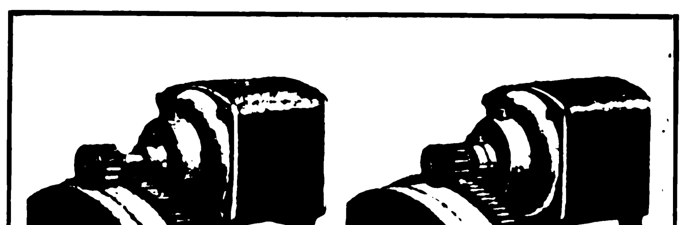
While the war has made it impossible for the De Dion-Bouton output to equal the programme made out early in the year, yet the plans now completed assure a constant supply of the various types of De Dion cars for 1915. A large portion of the company's factory at Puteaux, near Paris, has become a branch of the French artillery construction department, but the French maker assures a complete range of models for the forthcoming year. This includes the 10-horsepower four-cylinder car, with a bore of 2.2 inches and a stroke of 4.7; the 12-horsepower four-cylinder with a bore of 2½ inches and a stroke of 4.7; the 14-horsepower four-cylinder, with a bore of 2.8 inches and a stroke of five, in both home and colonial types; the 24-horsepower eight-cylinder, with a bore of 2½ inches and a stroke of five; 30-horsepower eight-cylinder, with a bore of 2.8 inches and a stroke of five, and the 50-horsepower eight-cylinder, with a bore of 3.7 and a stroke of 5.46.

With the exception of the use of Warland dual rims this year, the 1915 De Dion will be exactly the same as the previous year's model. It is hoped to introduce two new models early in the year. These will be a 12-horsepower four-cylinder and a 20-horsepower special speed model, intended only for light two-seated and four-seated bodies.

JEFFERY TRUCK FAVORED.

Much interest is being taken abroad in the performance of the Jeffery four-wheel drive truck, made by the Thomas B. Jeffery Company, Kenosha, Wis. The French war department favors this style truck for heavy work over difficult country, and one of these trucks recently arrived in England, via Canada. Officials who have watched the performance of this one truck on the Salisbury plain speak very highly of the machine in every way.

In the annual report of Lloyd's register, reference is made to the increasing use of internal combustion engines in large ships. There are now 27 vessels in service equipped with Diesel engines, and 27 others being built. There are 36 vessels afloat that are propelled by internal combustion engines other than Diesels, and many more in the course of construction.



Illustrating Action of Pinion of Brolt Motor Starter.

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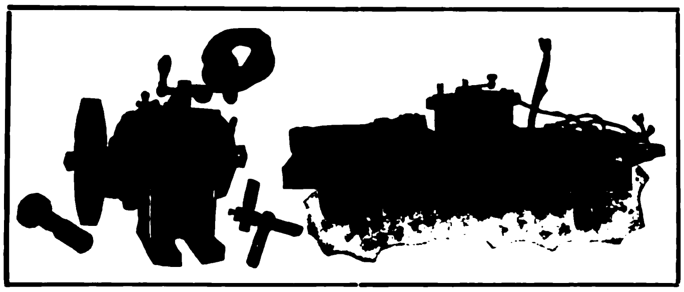
NEW MACHINERY, TOOLS AND SUPPLIES.

ELECTRICAL equipment and machinery are being more generally utilized in the garage and service station. Considerable work formerly consummated by steam, gas and other forms of energy, is now performed by the more economical and convenient power, electricity.



Westinghouse Electric Grinder and Vulcanizing Outfit.

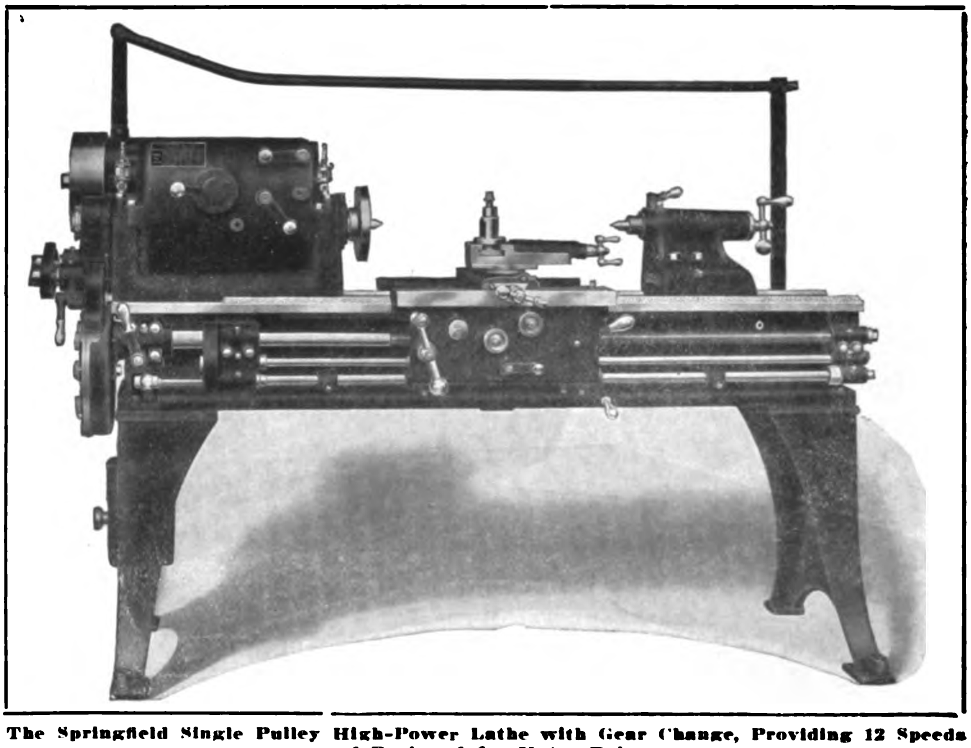
The Westinghouse Electric and Manufacturing Company, East Pittsburg, Penn., produces motors applicable to electrical machines and tools, and among them is the grinder shown herewith. It is designed for use on the lathe, planer, etc., and is particularly serviceable for motor vehicle work, as it has a wide range of utility. Another handy device is the electric vulcanizing equipment. A list of the manufacturers of these and other electrical appliances of a similar nature will be supplied by the company.

SPRINGFIELD LATHE.

The Springfield Machine Tool Company, 631 Springfield avenue, Springfield, O., maker of machinery, is manufacturing a lathe which is stated to be particularly adaptable to the requirements of service stations and repair shops handling motor vehicle work.

The Springfield is a single-pulley, high-power machine, and its gears provide 12 changes in speed, obtaining a sufficient range to adapt the lathe to all classes of work. The geared headstock is enclosed in a compact, dust proof housing, and a desirable quality of the construction is that all gears operate in a bath of lubricant. Sight feed oilers provide lubrication for the main spindle bearings.

The friction clutch pulley is located at the rear of the head, and is easily and quickly operated by a push rod. The belt is entirely out of the way of the operator, making for safety. A reversible drive, located in the head, is supplied when desired.



The Springfield Single Pulley High-Power Lathe with Gear Change, Providing 12 Speeds and Designed for Motor Drive.

The gear change is such that any speed may be obtained without passing through the other speeds, making for rapid work. Individual motor drive may be employed, if desired, and the motor may be located either on the floor, wall or ceiling, or at the back of the lathe or top of the head. Complete descriptive matter, prices, etc., will be supplied by the maker upon request.

BEARING DATA.

Garages and repair shops interested in data on fitting motor bearings are invited to write for the new booklet issued by the Harding Distributing Company, 28 School street, Boston, distributor of the Martell aligning reamer. The subject of bearings is treated at great length and a practical and scientific method of fitting motor vehicle types is described and illustrated.

UNIQUE RATCHET WRENCH.

A new wrench and equipment has made its appearance, and one of the desirable qualities of the tool is that the ratchet wheel, being the diameter of the smallest, or ¼-inch socket, enables the user to turn nuts very close to the wall. This makes possible the use of the wrench in places where the cold chisel is generally employed.

The Unique ratchet wrench is manufactured by Will B. Lane, 180 North Dearborn street, Chicago, Ill., and the complete equipment includes a seven-inch extension bar, two screw driver bits and sockets. The last-named members differ from the usual type in that

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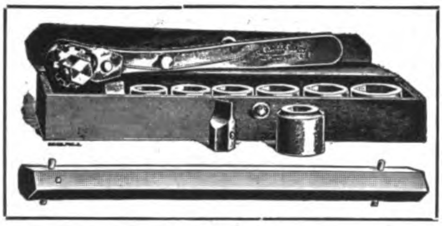


Unique Ratchet Wrench and Sockets.

they are turned out from a solid bar of steel, cold broached and hardened, and are guaranteed not to bend or split. The equipment permits of handling three standards of nuts, namely, the United States (bolt), A. L. A. M. and cap screws, and in a range of sizes which embraces about 90 per cent. of all the nuts on motor vehicles and machinery.

The Unique ratchet wrench is easily and quickly reversed, is made of the best material, and will withstand severe usage. It is simple in construction, and all its parts are carefully made and assembled. A special equipment is produced for the Ford chassis, and the maker states that parts not accessible with the usual equipment can be easily handled with the Unique tool. Particulars and prices supplied on request.

MERRY VALVE GRINDER.

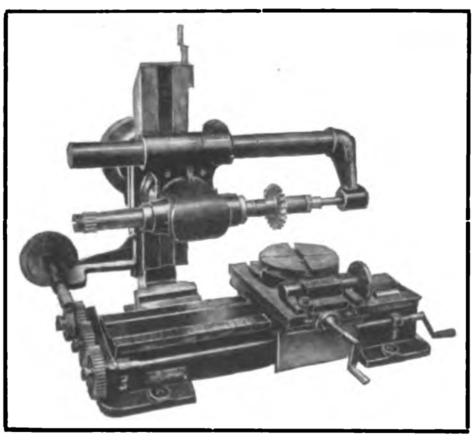
Edward Merry, Springfield, Mass., is marketing a valve grinder which is stated to be adaptable to all types of internal combustion motors. An outward stroke of a lever turns the valve 3½ times, and the return stroke rotates it similarly. It is stated that it may be operated at a speed of from 150 to 200 revolutions a minute.

WHEELER BENCH MACHINE.

A machine held to be adaptable to a large variety of work is the Wheeler bench machine, manufactured by the Hunt Engineering and Sales Agency, Los Angeles, Cal. It is a combination unit, and is driven through a three-step cone pulley and a telescoping shaft having two universal joints.

The spindle is one inch in diameter and has a standard No. 2 Morse taper. The plate is five inches in diameter, and the drilling capacity is ½-inch. It is stated that it is possible to cut standard threads from eight to 32.

The power feed is actuated by a train of gears on a radial arm so arranged as to engage the end of the spindle when in a horizontal position, or with a special worm gear driven by a cone pulley. The range of work possible with the machine is stated

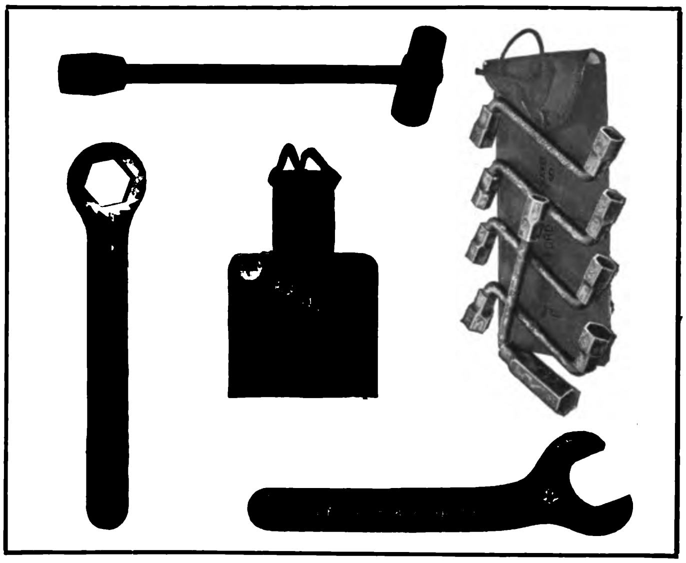


The Wheeler Bench Machine.

to be large, and among the operations are milling, drilling, turning, cutting Woodruff and straight keyways. Particulars and prices of the machine will be forwarded upon request.

NEW MOSSBERG TOOLS.

Concerns maintaining Ford delivery cars will be interested in the line of master tools for this machine which have been brought out recently by the Frank Mossberg Company, Attleboro, Mass. Some of the new types are shown in an accompanying illustration and include a reverse and brake pedal tension spring member which, it is stated, will save over 30 minutes when adjusting these members. The No. 640 wrench is a goose neck, having a plain open end, and is employed with the reverse spring. The No. 10 set of engineers' wrenches is of the thin model, open end type, and the set provides 10 openings. Another useful outfit is the 10 socket wrenches having hexagonal and square openings. These are particularly serviceable



Some of the Master Tools Produced by the Frank Mossberg Company for the Ford Chassis.

in adjusting the main bearings of the 1915 Ford. All of these tools are nicely finished and thoroughly hardened. They are sold with the usual broad Mossberg guarantee. Descriptive matter will be mailed upon request.

WEAVER GARAGE PRESS.

The Weaver Manufacturing Company, Springfield, Ill., is marketing a moderately-priced press which is particularly adapted to motor vehicle work. The press has a capacity of 20 tons, and is capable of handling all classes of machine shop work in addition to being especially designed to meet the demands of the repair shop. Many operations are possible with such a press and among them may be named the straightening of axles and crankshafts, pressing wheels on or off the shafts, etc.

The Weaver press has a one-piece frame of five by two-inch channel section steel, and there are no joints

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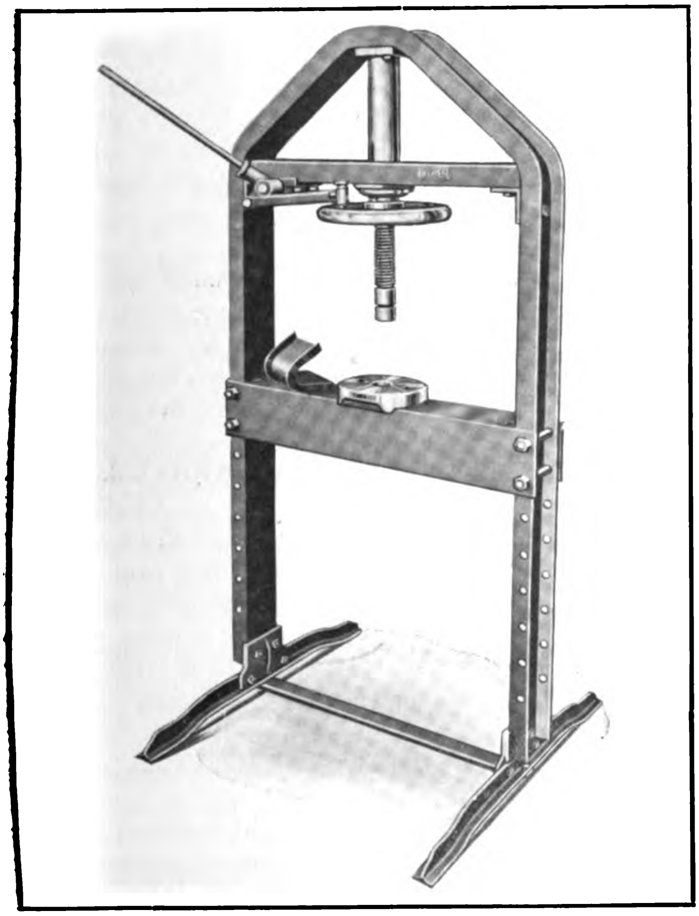
or connections, a construction making for great strength and durability. The 15-inch hand wheel is sufficiently heavy for large work and light enough to obtain quick action when handling ordinary work.

The maximum pressure is obtained by the lever construction shown in the accompanying illustration, and it provides a leverage of 1500 to one, and a maximum pressure of 20 tons is obtained easily. The bolster carrying the plate is adjustable to 48 inches between the plate and the bottom of the screw, and the last-named member is two inches in diameter, with a three-pitch Acme thread. The weight of the screw rests upon bronze thrust bearings, enabling the wheel to raise or lower the screw quickly. The distance of 32 inches between the uprights of the frame permits



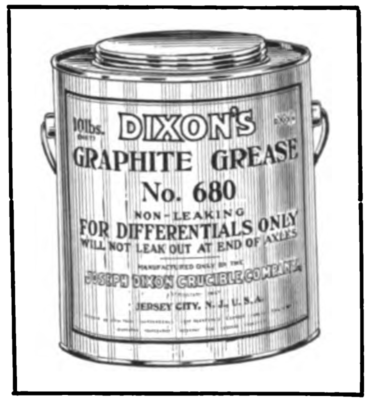
Weaver Press, Having a Capacity of 20 Tons, and Particularly Adapted to Motor Vehicle Work.

the press to take the largest sized motor vehicle wheels. A vise attachment for holding round or irregular work is provided, obtaining a wide variety of applications. The floor space occupied by the Weaver press is 36 by 36 inches, and the weight is 425 pounds.

Those interested in equipping the repair shop or service station with time and labor saving machinery should write the Weaver Manufacturing Company for details and prices.

NEW DIXON LUBRICANT.

The Joseph Dixon Crucible Company, Jersey City, N. J., well known to the motor vehicle industry as manufacturer of Dixòn graphite, is producing a new lubricant, which is particularly adaptable for service in commercial car differentials from which ordinary oils and greases leak out. The company believed that a flake graphite lubricant, properly prepared, would overcome this trouble, and after much experimentation and trial has produced the Dixon's No. 680. It is for service only when the Nos. 677 and 675 will not remain in the differential without leaking, and is not adaptable to gearsets. The Joseph Dixon Crucible Company invites correspondence upon its new product.

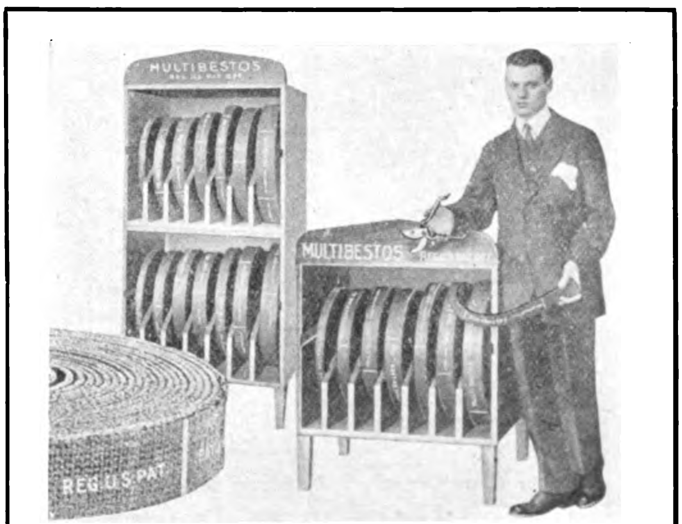


New Dixon Lubricant.

BRAKE LINING CABINET.

The Standard Woven Fabric Company, Framingham, Mass., maker of the well known Multibestos brake lining, announces that it will supply the trade handling its material with a cabinet. These cabinets, which are termed automatic salesmen, are built similar to a sectional book case and as many as are needed can be provided, fulfilling the requirements of both the small and large dealer. The cabinets are of natural wood and the company offers to stain them to match the wood work of the store. The design not only keeps the Multibestos brake lining clean and makes for easy handling, but displays the material to a good advantage.

The Standard Woven Fabric Company is introducing another innovation, one for which an application for a patent has been made, and is indicative of the progressiveness of the company, as it dispenses with rules or tape when filling orders. It consists of marking the brake lining with plain white lines at intervals



Brake Lining Cabinet Supplied by the Standard Woven Fabric Company, Maker of Multibestos Friction Material—Note the White Lines, Indicating Foot Lengths.

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of one foot. These "white foot prints", as they are termed, are an exclusive Multibestos feature, and not only save the dealer considerable time, but assure the purchaser of accuracy when buying.

THE WILSON TRUCK.

Announcement is made of a new 1½-ton truck which has been placed on the market by the J. C. Wilson Company, Detroit, Mich., long connected with the carriage business in that city. The specifications show a four-cylinder Continental motor, cast en bloc, with a bore of 4⅛ inches and stroke of 5¼ inches, and having a selective transmission, the gears of which are one-inch face, bolted to the jackshaft and mounted on a three-point suspension.

The ignition is by a high-tension magneto. The drive shaft is 1¾-inch tubular, the rear axle 2¾ by 1¾, with a spindle at the inner bearing 2⅛ inches in diameter and two inches in diameter at the outer bearing, the front axle being an extra heavy I beam section with two and 1⅞-inch spindles at the inner and outer bearings, respectively. The pressed steel channel frame is 5½ inches deep, with a 2½-inch flange, and is formed from 3/16 stock. The front springs are 42 inches long by 2¼ wide, and the rear members are 50 inches long by 2½ wide, all being of the self-lubricating type with extra large bronze bushings in both springs and hangers. The wheels are artillery type, having 12 two-inch spokes in front and 14 2¼-inch spokes at the rear, the solid tires being 37 by 3½ and 37 by five inches, respectively. Both the service and emergency brakes are on the rear wheels, taking the strain off the chains and jackshaft. The steering gear is located at the left, and is of the adjustable worm and sector type. The equipment includes a cab with storm curtains, oil lamps, mechanical horn, jack, and full set of tools. All parts of the construction are standard, and the most careful attention has been given to their simplicity and accessibility. The use of Sheldon axles Covert transmission, Eisemann magneto, Marvel carburetor, etc., indicate that the truck throughout is made up of parts of known value, and that it should prove serviceable and of the highest reliability.

MUST PAY NOTWITHSTANDING THE WAR.

An important court decision has been rendered in Great Britain by Justice Lush of the King's Bench division, London, relating to the enforcement of commercial obligations in favor of an alien enemy. The case arose from the refusal of Thomas Tilling, Ltd., a London motor omnibus company, to make payment of an account amounting to something over $25,000, on the ground that the creditor, the Continental Tyre and Rubber Company, while a registered British concern, was almost entirely owned by German stockholders, and, therefore, came within the scope of the law passed at the beginning of the war prohibiting dealings with or payments to any alien enemy. The court, finding that the position of the creditor company was in accordance with law, that the transaction on which the demand for payment was based was in all respects legal, and that the creditor was neither acting in the capacity of an alien enemy, nor were the payments demanded to be remitted to Germany, ruled that payment was not excused, and that judgment should be given against the debtor.

PIERCE TRUCKS VERSUS HORSES.

The George J. Meyer Company, malsters, of Buffalo, N. Y., after a year's operation of a Pierce-Arrow truck, finds that it replaces horses so efficiently that it has purchased another from the Pierce-Arrow Motor Car Company, Buffalo, N. Y. The bodies of both trucks are alike and were designed at the Pierce-Arrow factory from specifications furnished by the Meyer Company. They are carried on 204-inch wheelbase chassis, and are built entirely of steel, the sides and rear being at an angle of 25 degrees, sufficient to discharge malt or barley through hopper pockets on either side.

Before the Meyer Company purchased these trucks teams were hired as needed, on some days three or four, and on others as many as 10 or 12. Not only has the truck delivery proved to be cheaper, but customers are better satisfied with the service rendered.

MOTORIZED FIRE APPARATUS.

Mayor G. Woodward of Atlanta, Ga., at a recent meeting of the board of fire masters, said that he would begin immediate plans for motorizing the fire equipment now located in the most central parts of the city. The mayor estimates that $75,000 in January will give the department a good start.

TRUCKS HELP POSTOFFICE.

During the Christmas rush the motor truck was Uncle Sam's chief asset in the postoffice department. In Worcester, Mass., Postmaster James W. Hunt pressed into service several automobile trucks. This method of distributing articles was tried last year and its successful operation warranted its repetition.

MANY NEW JERSEY DRIVERS' LICENSES.

So far this year, 21,901 persons have been examined for driver's licenses in New Jersey, according to Motor Vehicle Commissioner Lippincott, the number passed being 19,471.

EXPEL ALIEN ENEMY MEMBERS.

The committees of the Automobile Club and of the Societe d'Encouragement pour l'Amelioration des Races de Chevaux en France, have unanimously decided upon the expulsion of members of alien enemies.

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BROWN REGULATED DISCHARGE TRUCK BODY.

DISTRIBUTION of material is a problem of much import with those engaged in surface construction, especially the building of highways. Highway engineering usually requires excavation to a sub-grade, which should be consolidated, and then on this are spread the courses of stone or gravel, which are generally rolled and made uniform in thickness and eventually finished with a dressing that for a time, at least, appears perfectly level.

The work is usually begun with plowing and the earth is removed, either for filling elsewhere, or it is dumped convenient to the job. Plowing is done by special type plows hauled by a road roller, and the loosened material is shovelled into carts and drawn away. As the surfaces are rough and soft the loads that horses can draw are comparatively small, and with manual labor for loading and with uncertain traction motor trucks are not often worked profitably when excavating is being done.

When the sub-grade has been reached and the excavation has been cleared, the consolidating is done with steam rollers. These machines make a path of from 78 to 84 inches, and because of the width of surface traversed the weight is comparatively small for each inch of area covered by the roller as it is moved. The consolidation completed, the distribution of the stone is begun, and the work can be done by hauling the loads onto the sub-grade, dumping the stone and levelling it with shovels and rakes.

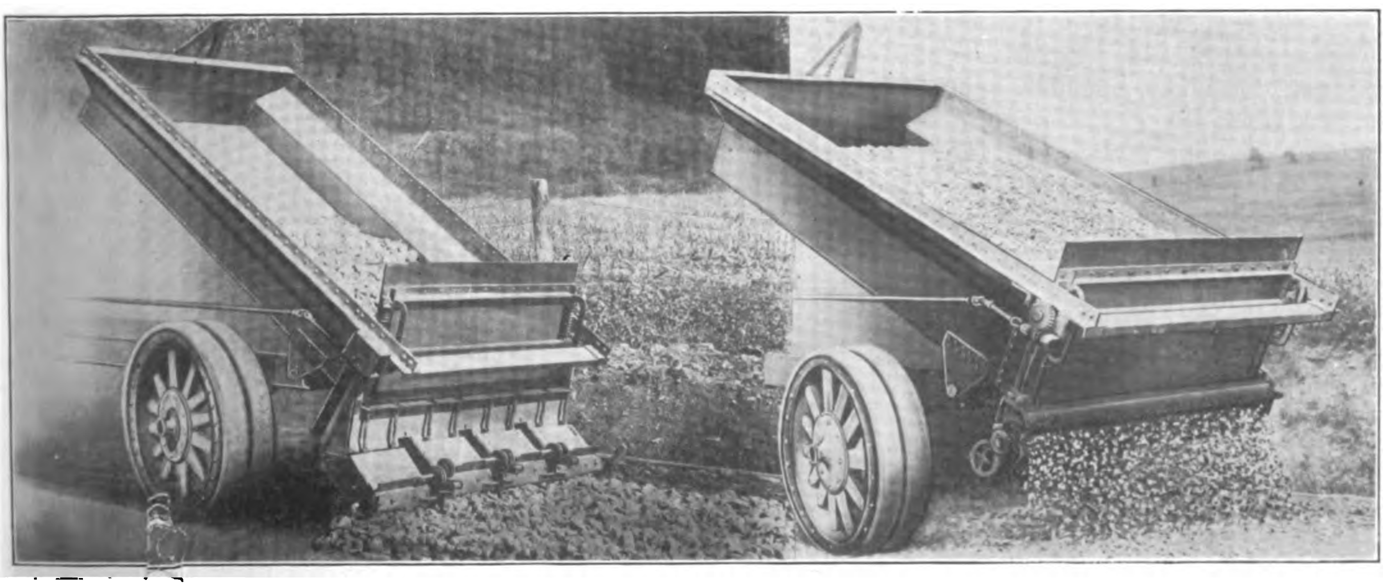
Stone dumped from a cart will be more compact at the bottom of the pile, and as the levelling is done the distribution is not equal, there being more stone in places, although the surface may not indicate this condition. This statement will apply to any number of courses of material. When the rolling is done the roller is supported by the most compact areas, and the consolidation is not equal. The result is that with the use of the finished road the traffic will develop depressions, where the material was not of sufficient depth to compact thoroughly.

Bodies have been constructed with end gates that can be adjusted so that the loads can be discharged as the vehicles are drawn or moved, but these are not thoroughly dependable because the volume discharged will vary with the speed. Gravity loading is practical at stone crushers, but dumping a load results in the unequal consolidation, no matter how carefully the work is done.

A body that is designed for accurate distribution of stone, sand, gravel or any similar construction material has been designed by J. Grove Brown, a mechanical engineer of Groton, N. Y., which is maintained by the designer to do the work with exactness and to insure the laying of a course of stone of any predetermined thickness that will be equal in compactness, save at the laps, where there may, and probably will, be some variance.

The statement is made that there will be no especial value in this form of body save when used for highway construction, but the equipment can be used for other work, and these bodies are made interchangeable with standard types, so that a vehicle will serve for many purposes, and yet have every advantage for the spreading of material in road building.

When used for road work the body is equipped with a spreading attachment that is shown in the accompanying illustrations. The equipment is quick dumping, and while that illustrated is operated manually by the driver, provision is made for the use of a power hoist should that be desired. The body is built of steel plate and with flared sides, this giving comparatively shallow depth and facilitating the discharge of the load at low elevations of the forward end. As the body is designed for distribution, an essential require-



Brown Regulated Discharge Truck Body Distributing Loads in Highway Construction: At Left, Spreading a Course of Stone for a Macadam Road; at Right, Laying a Top Dressing of Stone Screenings.

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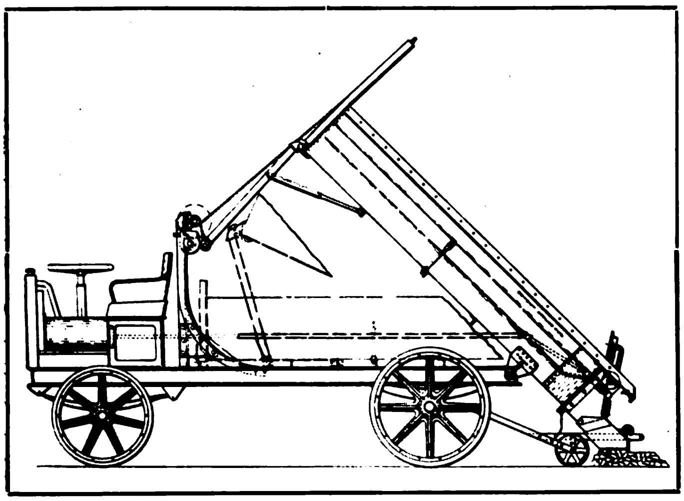
ment is that the load be discharged readily. As might be assumed, highway construction is not carried on during wet weather, but the material is seldom dry, and the body must be so elevated that the loads need not be trimmed. As designed, the top of the five-ton body is but slightly more than five feet above the ground, a fact of large importance when manual loading is necessary, and the low centre of gravity makes for greater safety when the machine is being worked on rough ground.

The body hoist is an unusual construction, and it includes a frame that is mounted directly behind the driver's seat. Near the top of the frame is a journalled cross shaft, on which are mounted two drums on which the chains that move the body are wound. These hoisting chains are attached to the end of an arm or strut that is hinged to fall beneath the body when it is lowered. From the frame carrying the hoist is an extension that forms a curved track that guides the free end of the arm or strut as the body is elevated or lowered. Besides the two chains for hoisting a



Elevation of Chassis Equipped with the Brown Regulated Discharge Body, Distributing a Course of Stone Evenly on a Road Surface.

third chain is attached to the top of the body, which is unwound as the body is raised and wound as it is lowered, which is intended to prevent the body being overbalanced should the truck be started while discharging, or while a load is being spread from the moving truck.

The spreading attachment, as will be noted from the accompanying illustrations, is attached to the rear end of the body, there being a special construction of the body to use this equipment. The body has comparatively short overhang. The illustrations show two types, those of actual operation being bodies with straight rear ends and vertical end gates, and that seen in the drawing having a pivoting end gate and the sides and bottom formed so that when the body is elevated the load is carried by gravity into what is virtually a hopper. The end gate is raised by a worm and gear operated from the driver's seat.

The outline sketch shows a frame beneath the rear end of the body, that is mounted on one or two auxiliary wheels, and is maintained in position by two radius rods that are pivoted at either end. These wheels contact with the ground only when the body has been sufficiently elevated. Chain stops support the frame when the body is lowered. Connected with the body by pivots is a telescopic chute, the lower end of which is mounted in the frame, which is the full width of the body. Back of this chute outlet in the frame is the levelling or evening edge, which is dragged over the surface, bringing it to exact height. This edge can be set to any desired height for practical purposes. The spreading attachment can be adjusted so that the material can be distributed to a given depth.

The two illustrations show different forms of spreaders, the one being used for laying a course of crushed stone, and the other for spreading the top dressing, this being a much thinner coat. With both types the spread is the width of the body. These attachments can be removed when the machines are used for other work, but the end gates and the operating mechanisms are retained.

The fullest operating utility of the motor truck in highway construction is obtained with a special type chassis that has a short wheelbase, with forward wheels that have increased movement, so that they may be turned from 40 to 45 degrees, instead of the usual 30 degrees, which will afford a shorter turning radius, a particularly desirable quality.

ASK CHANGE OF TRUCK ROUTES.

Residents of Beacon street, Boston, Mass., are circulating, among merchants who operate commercial vehicles in the Back Bay district, a request that except when making deliveries other streets be used. It is pointed out that Boylston street is now in good condition and there is no reason why it should not be used.

MILWAUKEE DEALERS ORGANIZE.

The automobile and supply dealers of Milwaukee, Wis., at a meeting recently held at the Hotel Pfister, decided to form an organization for the maintenance of prices, the development of a system of protection against dead beats, and for united legislative action. The meeting, at which 100 were present, was addressed by Francis L. Plummer of the American Fair Trade League.

KNOX COMPANY LOSES SUIT.

The suit of the former Knox Automobile Company, Springfield, Mass., against the city of Worcester, Mass., to compel the acceptance of and payment for four pieces of motor fire apparatus, valued at $20,000, has been decided in favor of the city by the full bench of the supreme court.

The complete elimination of the horse policeman and substitution of motorcycle officers is suggested by the superintendent of police at Washington, D. C.

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CORRESPONDENCE WITH THE READER.

Valve Caps—Driver, St. Louis, Mo.

Can you give some suggestions for removing and replacing valve caps in an old motor? The caps on my engine are badly worn and some one has been using a cold chisel on them, judging from their looks.

The valve caps on motors are subjected to considerable abuse, and cold chisels, hammers, etc., are employed to remove and replace them. Frequently the castellated tops are badly damaged through abuse, and when such is the case it is best to discard them and purchase new, as they are not expensive.

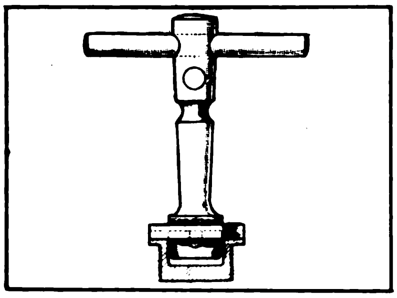

Fig. 1—Valve Cap Wrench.

If one is handy with the lathe, a valve cap tool, such as is shown at Fig. 1, can be made without expense. Take a piece of steel of suitable length and of the same diameter as the bore of the valve cap, centre both ends, and turn one end to a slight taper so that it will fit snugly into the recess of the cap.

Next drill three ¾-inch holes to take a lever which may be held with a pin. Next drill a hole in the larger diameter and file this out square to take a piece of 7/16-inch square steel, the length equal to the outside diameter of the valve cap. It is stated that this tool will enable one to remove the caps easily and to set them up so that they will be gas tight.

Priming Mixture—Information, New York City.

What proportion of sulphuric ether and ordinary gasoline should be used to make a good working priming mixture?

Ordinarily about one part of ether to two of gasoline will obtain the desired results. Because of the extreme volatility of the mixture, it should be stored in a receptacle having a tight stopper. A glass bottle, having a ground glass stopper, such as employed for perfumes, makes an excellent receptacle for the ether preparation.

Hard Starting—Ford, Boston.

We have a Ford machine which we use for covering considerable territory. During the cold snap of late it is hard to start. One day, after the machine had been left out about an hour, our driver could not start it and we had to be towed back to the garage. After a while it started easily. The garage is heated. It always has started in cold weather with priming. What was the trouble?

The trouble was probably due to the water in the filter freezing and preventing the fuel from reaching the carburetor. The writer knows of several instances where this trouble was experienced, and in every case the motor started after the filter was cleaned. The function of the filter is to collect or trap any water that may be present in the fuel, and if one neglects to occasionally drain it, the water will accumulate to such an extent that when it freezes it shuts off the supply from the tank.

If the motor fails to start, especially after being exposed to low temperatures, open the petcock on the carburetor and note if the fuel flows freely. Enough gasoline should be drawn off to make sure that the line from the filter and the float chamber of the carburetor is emptied.

Series and Multiple—Reader, Newark, N. J.

I operate a Ford delivery car and am going to fit it with electric side and tail lights. Am informed that it is best to wire the tail lamp in series with the dash or the side light, so that if the tail light bulb burns out the dash lamp will go out. Please supply me with a drawing showing how to wire the lamps and explain the reasons for the dash light going out.

The wiring plan of lamps in series is shown at Fig. 2 A, and, in multiple, at B. The former method is practically the same as wiring dry cells in series in that the connections are made in such manner that the current flows from the positive (+) terminal of the battery through the filament of the first lamp, thence to the second lamp and so on back to the negative (—) terminal of the battery, completing the circuit.

The three lamps may be compared to switches in the circuit in that each closes the circuit, providing a path for the electricity. If, however, a filament of any of the three units burns out, it breaks the circuit. For example: Assuming that the first and last lamps are the dash and tail light members; upon the filament of the last-named bulb breaking or burning out, the electricity will not flow because of the fact that, for current to flow from a battery, a path must be provided for its return, that is, from the positive to the negative pole.

The drawing at B shows parallel or multiple wiring. As may be noted, all of the positive terminals of the bulbs are connected to each other through one wire, and the negative wire attached to the negative terminals of the lamps. With such an arrangement, the burning of a filament will not interfere with the utility of the other bulbs, as a path is provided for the current to flow through the other filaments. Under these conditions it would be possible to obtain light from one bulb when two were broken.

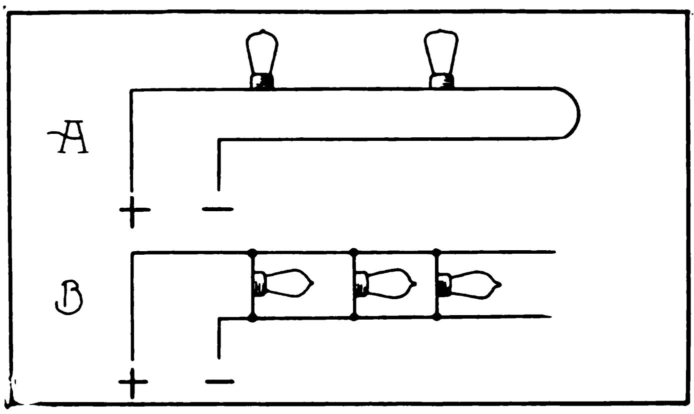

Fig. 2—Wiring Diagram for Bulbs: A, Series; B, Parallel or Multiple.

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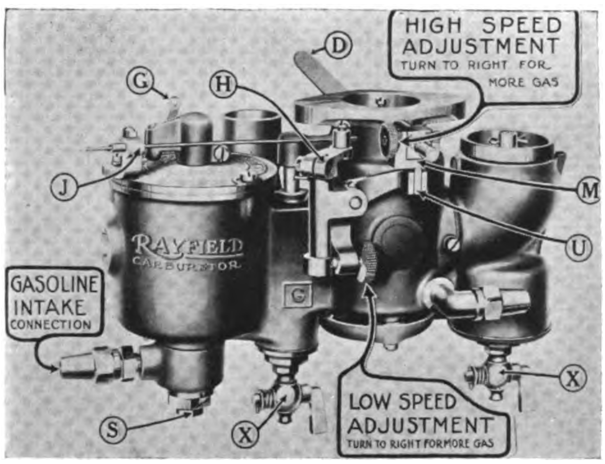
HINTS FOR PROPER MAINTENANCE.

MANY drivers tamper with the adjustment of the carburetor in cold weather, believing that they can improve starting conditions. Generally this results in trouble, to say nothing of a waste of the fuel, for usually the novice obtains too rich a mixture.



Illustrating Components Utilized in Adjusting the High and Low Speed of the Models G and L Rayfield Carburetors.

If one has tampered with the adjustment of the model G or L Rayfield carburetor, it may be properly reset by the following method:

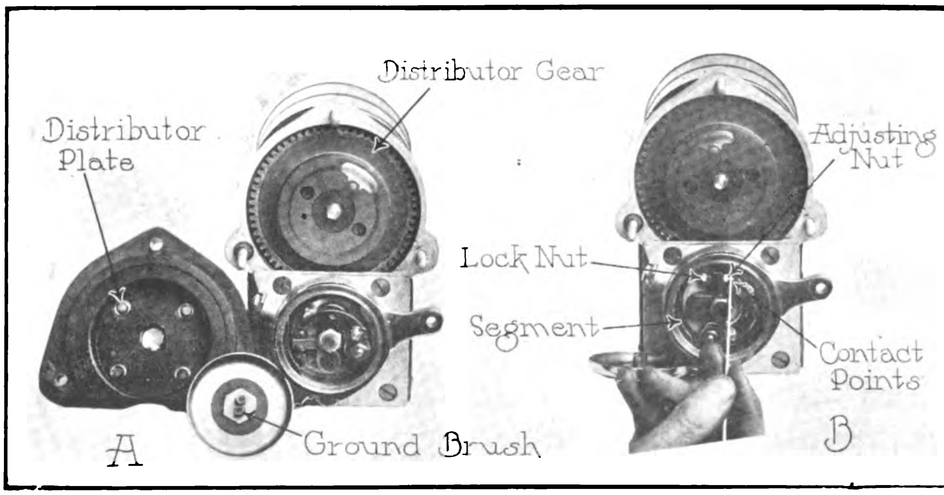
As may be noted by the accompanying illustration, there are two adjusting members, one for the high and the other for the low speed. The low speed is adjusted first. With the throttle closed and the dash control in the running position, seat the nozzle needle by turning it to the left until the block U breaks contact with the cam M. Next turn the needle about three turns to the right, open the throttle about one-quarter way and start the motor. After the engine has become warm, cut down the fuel supply by turning the low-speed knurled nut to the left until the motor idles and operates smoothly. During this work the spark should be retarded. To adjust the high, advance the spark about one-quarter and open the throttle quickly. If the motor back-fires, it will indicate a lean mixture and the high-speed knurled nut should be turned to the right a notch at a time to increase the fuel supply. The throttle should be operated after each adjustment to note if the motor responds quickly to the mixture, and by noting the odor of the exhaust an over-rich mixture may be determined. The low speed should not be disturbed in setting the high, as these are independent of each other. The maker of the Rayfield states that after his product is properly adjusted it is not affected by climatic changes.

MAGNETO CONTACT POINTS.

Operators of motor vehicles equipped with true high-tension magnetos should occasionally inspect the contact points of the breaker mechanism, for after considerable service these members will require readjusting and, possibly, cleaning. It should be borne in mind that the function of these points is to break the flow of the primary current, and that the spark at the gap of the plugs practically takes place at the same instant. If the space between the contact points be increased over normal, the break will be late and the starting and operation of the motor affected. Dirty or fused points will impose an unnecessary resistance in the circuit.

The work of cleaning and adjusting the contact points of the average magneto is not difficult. The first step is to displace the circuit breaker cap or cover, and to crank the motor until the armature shaft of the magneto occupies a position that will insure complete separation of the contact points. There are two of these points, one a fixed member and the other movable. The break of the points is obtained by a roller, as shown in the case of the Splitdorf magneto illustrated herewith, coming in contact with a metal segment when the armature shaft is rotated. This position is indicated at A.

To ascertain if the platinum points are fused or dirty, move the lever carrying the roller in with the finger as shown at B. If the points require cleaning, employ a very fine jeweller's file, as illustrated. Move the file up and down slowly and be careful not to twist the tool in the operation, as it is most important that the points be filed true. The tension of the spring



Contact Points of Magnetos: A, Showing Points Separated; B, Illustrating the Proper Use of Very Fine File When Cleaning or Truing Points.

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of the lever carrying the roller will be sufficient.

After cleaning the points, test the gap with the gauge accompanying each magneto. Do not attempt this operation by guess work as, 99 times out of a 100, it will result in too large a gap. A gauge costs but a few cents and can be obtained at any supply house or branch of the maker of the magneto.

If it be found that the blade of the gauge slips easily between the contact points when they are fully separated, loosen the lock nut and turn the adjusting nut of the platinum screw outwards. This will decrease the space. It is probable that only a slight turn of the screw will be necessary to correct the space, which should be checked with the gauge. After making sure the gap is correct, tighten the locking nut.

KNOX LITIGATION CLEARING UP.

While the end of the legal troubles of the bankrupt Knox Automobile Company, Springfield, Mass., is not yet in sight, some of the troublesome points raised in connection with the suits of a committee of stockholders and by the trustee in bankruptcy against the administrators of the estate of the late Alfred N. Mayo, have been cleared up by decrees filed recently by Judge Jenney in the superior court. The suits in question were brought to recover from the estate certain sums which are alleged to have been improperly diverted from the treasury of the corporation. The stockholders' committee sued in equity, and in law, and to both suits demurrers were filed by the estate, which have been sustained, but the cases have been reported by the court to the full bench that the questions covered by his decision may be determined by the final tribunal. In the suit by the trustee, which covers essentially the same points and to which demurrers were also filed, the defendant is sustained on the first count, but overruled on all others, and it is likely that the case will go to trial on these.

BULL TRACTOR FOREIGN PATENTS.

The Bull Tractor Company, Minneapolis, Minn., has purchased of D. M. Hartsough, inventor of the Bull tractor, all his patents and interests applying in all foreign countries, including Canada. It is expected that the acquisition of these rights will increase the tractor company's business 100 per cent. in 1915, and that an increased number of men will be employed in their manufacture.

P. J. Lyons, president of the company, said that the concern will manufacture its entire 1915 output in Minneapolis. He states: "European representatives who are now here assure us that, whether the war ceases soon or continues, there will be a great demand for tractors. The agricultural power of Europe has been practically destroyed and Europe must look to this country for machinery and power to rebuild it". Arrangements have been made with the Minneapolis Steel & Machinery Company for the use of a much greater portion of the capacity of that plant than was had last year.

SUCCESSOR TO J. S. BRETZ COMPANY.

The Bearings Company of America, New York City, is the successor of the J. S. Bretz Company, New York City, the Fichtel & Sachs Company and the Star Ball Retainer Company, both of Lancaster, Penn. All three companies were dissolved during 1914, the idea being to concentrate the entire manufacturing, warehousing and the shipping and service departments at Lancaster, and the entire sales department at 250 West 54th street, New York City.

In speaking of this consolidation, J. S. Bretz said: "No change has been made in the personnel of the general management of the business, the idea being to continue it under the same efficient direction as heretofore in the sale, production and importation of F. & S. annular ball bearings, ball thrust bearings, Star ball retainers, German steel balls and Bowden wire mechanism".

SEEK PATENT AGREEMENT.

A suggestion has been offered by the National Automobile Chamber of Commerce, New York City, along the lines of a cross licensing agreement, providing for an interchange of licenses on patents between motor vehicle manufacturers. It was suggested that, while each of the motor vehicle companies holds some patents of great value, it is better for the industry that each concern, while developing its own ideas, should be free from attack on patents owned by others.

'BUS FOR ST. JOHNSBURY.

It is proposed to establish a 'bus line at St. Johnsbury, Vt., to be run through the principal streets, and the service may be extended to nearby towns if an opportunity is offered. A $20,000 corporation is contemplated, the organization to be local, but it will have the benefit and experience of the General Transportation Company, Boston, Mass., as this concern is stated to be interested in the transaction.

MOTOR TRUCKS FOR ENGLAND.

The British government is preparing estimates for 6500 motor trucks, according to advices received by Chicago manufacturers. This order, it is estimated, would amount to $10,000,000, as the trucks will probably average $1500 each.

The Chase Motor Truck Company, Syracuse, N. Y., has re-elected its officers and directors for the fiscal year of 1915 as follows: A. M. Chase, president; H. P. Bellinger, vice president, and E. A. Kingsbury, treasurer.

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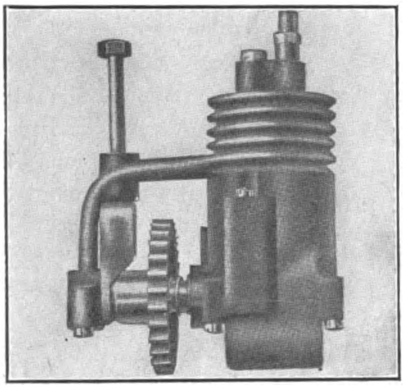
NEW COMMERCIAL CAR ACCESSORIES.

SANFORD TIRE PUMP.

The Brown Company, Syracuse, N. Y., is manufacturing a practical as well as high-grade efficient pump for the model



T Ford car, which is not only moderately priced, but is gear driven. One of the desirable qualities of the pump is that the driving and driven gear can be meshed easily and quickly by a lever. The pump is very compact and the workmanship and material are first-class in every respect.

One of the features of the design that will appeal to those owners installing new equipment is that the SanFord can be attached in 30 minutes and that no drilling or machining is necessary. The pump supplies air free from lubricants, and the maker states that it is constructed to withstand hard service.

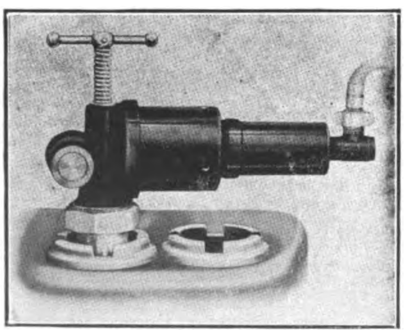
One of the features of the pump is the method of adjusting and packing. This is accomplished by means of a ring on the inside of the pump, so constructed that it may be adjusted from the outside for wear, etc. It comes complete, with gears, hose and gauge.

MAYO POWER TIRE PUMP.

Announcement is made by the Mayo Manufacturing Company, 60 East 18th street, Chicago, Ill., of a new type of power tire pump. It is designed to be permanently attached to the motor and, as may be noted by the accompanying illustration, the pump is provided with a connection which screws into the valve cap. This connection is fitted with a standard ground poppet valve, similar to that employed in an internal combustion engine, and is held on its seat by a spring.

To employ the pump the handle is pressed downward and, with the motor running, air is pumped into the hose, thence to the tires, a suitable length of tubing and a gauge being provided with each outfit.

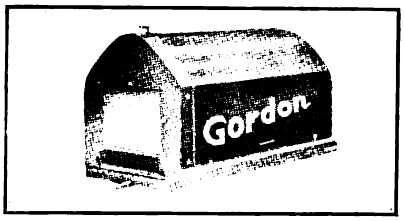
To attach the connection to the valve cap, the latter is drilled and tapped. A union joint permits of the easy connection of the valve member and the pump proper. The maker states that the pump will inflate a 34 by four-inch tire to 75 pounds in three minutes, and other sizes



and pressures in proportion. After service, the pump handle is locked by giving it a quarter turn. The Mayo valve cap plug comes complete with specific instructions.

GORDON RADIATOR COVER.

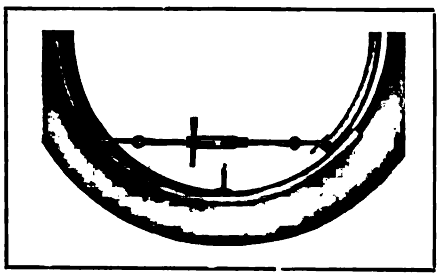
The J. P. Gordon Company, Columbus, O., is marketing the Gordon radiator and hood cover, which is constructed of weather proof fabric on the outside and lined with a material which, it is stated, will prevent the escape of the heat from the motor. The cover is designed for service in cold weather and for keeping the water of the circulation system warm when the engine is not running. The hood cover is so attached that the hood can be raised and the method of fastening is such that it cannot be easily stolen. The curtain is adjustable, so that the opening may be regulated ac-



cording to the weather. Covers are made for the radiator, as well as for the double member.

STANWELD RIM TOOL.

In keeping with its policy of producing material lighter in weight, and accessories more easily operated, the Stanweld Company, Cleveland, O., has brought out a special tool for the transversely split type of demountable rims. These rims are very generally employed and the Stanweld Company, after much experimentation, has designed and patented the special tool shown in an accompanying illustration. It operates on the principle of a turnbuckle, is made in one size, and fits any make, diameter or width of split rim. The use of the de-



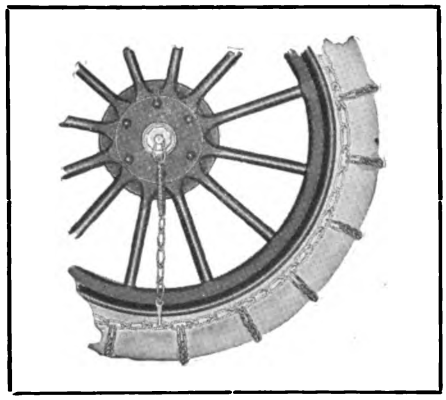
vice requires the drilling of four small holes, two in each side of the rim base. The Stanweld rim tool can be folded into a space nine by five inches and weighs 1½ pounds.

AUTOMATIC REDUCING VALVE.

The Prest-O-Lite Company, Inc., Indianapolis, Ind., is marketing an improved form of automatic reducing valve for its gas tanks. It is a practical and useful device as, after attachment, the pressure is automatically regulated regardless of the position of the regular valve. This arrangement not only saves gas, but time, as the flame cannot flare, as it is always the same, regardless of variations in the supply of acetylene. The device is provided with an adjusting member so that any desired flame may be obtained, and after being once set requires no further attention. The reducing valve is easily attached and practically in the same manner as the regular union.

NON-SKID PROTECTOR.

Bornstein Brothers, 11 Caledonia avenue, Rochester, N. Y., is marketing the Non-Skid chain protector, which the



maker states will prevent loss of the tire chain in the event the retaining chain breaks. The device, which is stated to be patented, consists of a chain and a grooved nut or button. The last-named member is secured to the hub cap of the wheel by drilling a 5/16-inch hole and inserting a special bolt and button. The chain protector is attached by snapping one end to the button and the other to the tire chain. A special spring keeps the chain taut, preventing rattling. The protectors retail for $1.25 the pair.

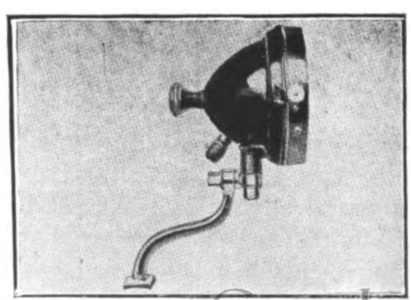
KEMCO MOTOR STARTER.

The Kemco Electric Manufacturing Company, Cleveland, O., maker of the Kemco fan type generator, has brought out a motor starter for the Ford car. It is attached to the front of the machine and has a magnetic clutch which, when actuated by the application of the battery current, moves a claw into engagement with the pin on the crankshaft of the engine, and spins the shaft at a high rate of speed. Upon the engine starting the claw automatically disengages. The operation is practically the same as when the motor is cranked by hand. A feature of the unit is that it can be installed without displacing the radiator.

ELECTRIC SPOT LIGHT.

The Victor Auto Parts Company Cincinnati, O., specialist in the manufacture of motor vehicle lamps, is marketing what is termed the fore door electric spot light. It is designed to be attached to the car by means of a bracket having a universal joint, a construction that permits of swinging the light in any direction.

The swivel, alhough moved easily, is stated to be held rigidly in place by means of friction, and it is claimed that the lamp will not jar out of position. The reflector is not a true parabola, but of a special shape. The light is very serviceable in that it may be utilized to illuminate road signs, street numbers, etc., and highway curves. The lamp is 6½ inches in diameter.



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ADAPTS KISSELKAR TRUCK TO TRAILER.

WITH the ever increasing adoption of motor equipment by fire departments it is interesting to note the excellent work being performed by a KisselKar truck at Patchogue, Long Island. This vehicle, made by the Kissel Motor Car Company, Hartford, Wis., consists of a 1½-ton Kissel truck chassis, on which is mounted a patented fifth or oscillating wheel. This tractor may be attached to any style of horse drawn vehicle, and in this particular case the Patchogue department has applied it to a hook and ladder trailer.

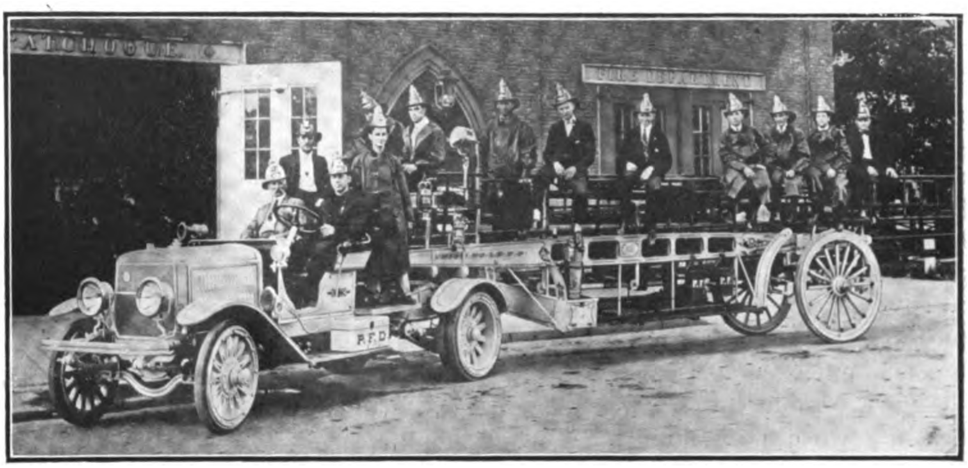
The chassis of the KisselKar fire truck is designed and built entirely in one factory. The motor, a four-cylinder, four-cycle, water cooled, L head type, with cylinders cast in pairs, is of standard design. The valves are all placed on one side and operate on a single camshaft. The cylinders and pistons are bored, ground and lapped in special lapping machines so that each part is exactly fitted to the part with which it belongs. The water jackets are cast integral and the cylinders are large and so designed that the cool water enters the hottest part of the motor.

A summary of the component parts of the motor shows: The connecting rods are extra heavy forged I beam sections; the bearings caps are held in place by four stud bolts and double lock nuts, castellated and cotter keyed; the valves are machined from drop forged nickel steel blanks, having the heads integral with the stems, and are accurately turned and lapped into their seats; the crankshaft is of heavy drop forged nickel steel, heat treated and with all bearing surfaces accurately ground; the shaft is supported by three special white bronze bearings, cotter keyed through castellations; the camshaft is a solid bar with the cams securely held in place by taper steel pins of extra large size; the shaft and cams are accurately ground in a special camshaft grinding machine, and are case hardened and heat treated; the crank case is a two-piece aluminum casting provided with numerous ribs, giving added strength without excess weight; the upper half of the case rests on and is bolted to a sub-frame running parallel to the main frame and supported at the ends by the cross members of the main frame; the lower half of the crank case, which forms the oil reservoir, is readily removable for the inspection of the connecting rod and crankshaft bearings.

The lubrication is by pump and splash. The self-contained oiling system consists of a special tank, or oil reservoir, from which the oil is forced by a gear driven pump into the splash basin and to all parts of the motor. The surplus oil drains back into the reservoir in the conventional manner.

The ignition is by a Bosch high-tension or Mea magneto, dual system, a coil with double-throw switch and a starting button mounted on the dash or igniter system. The magneto shaft is of nickel steel and fitted with a universal joint, which permits the magneto to be disconnected and taken off for repairs, if necessary. The carburetor is of the float feed type, with automatic auxiliary air intake and water jacketed chamber.

The cooling is by a positive circulating system actuated by a centrifugal pump fastened to the same shaft that operates the magneto. The radiator is of the honeycomb type, solidly fastened to the main frame of the car and to the front cross member. A fan is placed immediately behind the radiator and driven by a belt from the magneto shaft.



The KisselKar Fire Truck and Trailer, Which Has Been Installed in the Patchogue, Long Island, Fire Department.

The clutch is the leather faced cone type with an extra wide face setting deep into the flywheel. The clutch shaft fastens to a double ball universal joint connected to the transmission shaft and so arranged that in the event of a bolt, or any part of the joint working loose, it would not damage the clutch or transmission.

A worm and sector steering gear of the irreversible type is employed. The shaft and worm are of one-piece construction, machined from a solid upset piece of nickel steel. The entire mechanism is enclosed in an oil tight malleable iron case. Suitable bearings are provided, and adjustment can be made without removing any part. The steering arm is a heavy I beam section having a broached hole fitting over a square shaft and held in place by a clamping bolt and taper pin. The steering wheel is 20 inches in diameter, with an aluminum spider, having a corrugated wood rim. The motor control is by the conventional spark and throttle lever at the top of the steering wheel and by an accelerator pedal. In both

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the spark and throttle control the rods are fitted with ball and socket joints, which are designed to eliminate lost motion in these parts and to prevent play in the linkage.

The transmission is of the selective sliding gear type with four speeds forward and reverse, with the direct drive on the third speed. The gears are all chrome nickel steel, with shafts of nickel steel, heat treated. The sliding gears are broached to slide on a splined shaft. The countershaft gears are all held in place by Whitney keys and hardened sleeves. The transmission is hung amidship on the same sub-frame that supports the motor. The case is a one-piece aluminum alloy casting with the cover bolted on. The cover, which forms the entire top of the case, may be readily removed for inspection of the gears, while a small opening in the large cover permits of grease being put into the case by removing the small cover plate.

An extra large differential is employed. This is made of chrome nickel steel and supported by double Timken bearings. The pinion shaft is also supported by two Timken bearings, which insures an exact alignment of the drive pinion with the bevel gear at all times and permits of an easy adjustment, as all components are readily accessible.

A device is provided whereby the differential may be locked by means of a pedal at the driver's feet. This device permits the power to be transmitted to one wheel in case a chain breaks, or to both wheels alike in case one wheel should drop into a hole or strike an icy pavement or mud. On cars of this type the company says that this device is an absolute necessity, as sure and quick service cannot in all cases be had without it. To go into greater detail, it is shown that when one wheel drops into a hole where mud and ice will cause it to slip, the differential acts and permits the wheel in the hole to spin, while the one on solid footing will stand still. In this case, without the differential lock, it is impossible to move the truck until some way is devised to get both wheels where traction may be had. With this device, however, the power may be transmitted to one or both wheels, and with one chain broken the machine may be propelled the same as though both were intact. In case one wheel is in mud and spinning, as stated above, the power may be transmitted to the wheel on solid footing.

The service brake is of the external contracting band type on drums. The emergency brake, acting on an internal expanding band, is operated by a lever in the ordinary manner. The semi-elliptic front and rear springs are made of chrome vanadium steel, and are 38 inches long in front and 54 in the rear. The wheels are of the artillery type, 34 inches in diameter in front and 36 in the rear. The front tires are 34 by four solid Goodyears, and the rear are 36 by 3½ dual Goodyear solids. All are fitted with demountable rims. The wheelbase is 144 inches and the tread is 63 inches.

MOTOR APPARATUS SHOWS ECONOMY.

The report of Captain M. J. Dumphy of the Tenth street fire house, Sacramento, Cal., shows a remarkable saving resulting from the use of motor apparatus which has, for the past year, replaced the horse drawn equipment. The report shows a total expense for the two pieces of apparatus, a motor fire engine and a motor hose wagon, of $8.96 for the year, this figure including a gasoline bill of $4.40. With the old equipment, the cost for shoeing was over $400, and for feed nearly $1000 a year and, while the saving shown is probably better than the average will be after the apparatus gets older and occasional tire replacements become necessary, the statement of C. W. Anderson, the chief of the department, that motor apparatus will pay for itself in three years is likely to be not far out of the way. In addition to the factor of economy, the radius of effective action has been doubled, and the pumping capacity increased 30 per cent.

LOW OPERATING COST IN QUINCY, ILL.

The report of Chief John Q. Hawk of the Quincy, Ill., fire department, shows a total operating cost for the five pieces of motor apparatus, for the month of October, 1914, of $27.63. The items, which are of interest, are as follows:

Pumping Engine—Ran 23.6 miles and used 20 gallons of gasoline, costing $6.91.
No. 2, Squad Car—Ran 86.9 miles and used 25 gallons of gasoline, which cost $4.25.
No. 3, Hose Car—Ran 196 miles, using 25 gallons of gasoline, which cost $4.21.
No. 4, Hose Car—Ran 70.7 miles, using 35 gallons of gasoline, at a cost of $6.32.
Chief's Car—Ran 223 miles, and used 35 gallons of gasoline, which cost $5.94.

This cost for the month is not more than the keep of a single pair of horses, and the service is far greater than such apparatus could possibly have performed.

USES ELECTRIC MOTIVE POWER.

After considerable investigation, Philadelphia, Penn., in October, 1913, put into service an attached electric storage battery tractor as motive power for a first-class steam fire engine, the combined equipment weighing 17,000 pounds. The battery consists of 80 cells, giving a range of 35 miles on a single charge at 15 miles an hour, or 20 miles at 25 miles an hour. After a full year of use the battery shows little deterioration and the service has been satisfactory in every particular. The cost of operation has averaged $4.50 a month for current and care of batteries, and no repairs of importance have been necessary.

MUNICIPAL GARAGE IS NEEDED.

The necessity for a garage where all the automobiles used by the city may be housed and cared for is being felt, and the success of the municipal garage opened in Baltimore, Md., something over a year ago

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resulted in plans for similar equipment in other cities. At present, in almost every case, each department cares for its own cars, and it is certain that a great gain in efficiency and economy will result from a central garage and repair shop with up-to-date equipment and competent management.

SUCCESSFUL TEST OF MOTOR PUMP.

At a test of the Ahrens-Fox motor driven pumping engine and hose wagon, recently purchased for the San Antonio, Tex., fire department, held prior to its acceptance by the city, 1063 gallons of water a minute were pumped, or 313 gallons in excess of the specified capacity. Four streams were forced over the top of a 25-foot flag staff on the top of a seven-story building and, when three lines were siamesed, an estimated altitude 30 feet greater was reached with a single stream.

ST. CLOUD, MINN., IS UP-TO-DATE.

Since the appointment of Louis Moosbruger as chief of the St. Cloud, Minn., fire department in 1901, a position which he has held ever since except for a brief interval, the equipment has been entirely changed, and now consists entirely of motor apparatus. Chief Moosbruger on Dec. 11 last celebrated his 25th anniversary as a member of the department, and it was in the course of the celebration that this interesting information was brought out.

FIRE TRUCK MAKES GOOD RUN.

Responding to a call for help at a recent fire in LeMoyne, Penn., a three-way La France truck, on exhibition at the Hope Fire Company's house at Harrisburg, Penn., made the run of 2½ miles and had two streams on the fire in eight minutes. The blaze, which was in a garage, looked serious, and great credit is given the representative of the La France Company and his apparatus, for the prompt and effective service.

COMPLETE EQUIPMENT FOR POINT GREY.

The inauguration of a motor fire fighting equipment, consisting of a chief's car, a combination chemical and hose cart, and a city service truck, with a triple combination hose, pump and chemical to come shortly, is the record of Point Grey, B. C., since Jan. 1, 1913, on which date it had no fire department of any sort.

GOOD RECORD IN COLUMBUS, O.

The Columbus, O., fire department has reported that the cost of truck No. 4, at engine house 10, for one month in which three alarms were answered, was 77 cents, as compared with a monthly cost of $31, when the horse drawn apparatus was in use. During October 20 motor driven pieces of equipment were driven 2452½ miles at a total cost of $169.05, the expense for the same period with horses being $837.

GARY, IND., HAS MOTORIZED.

The six-year-old Gary, Ind., fire department has become motorized, a $6000 motor hook and ladder truck having been delivered on Dec. 15, completing the equipment. The anniversary of the organization of the department, on Dec. 14, was marked by a lively fire, which the extreme cold made difficult to handle.

MANY CITIES GETTING IN LINE.

Canton, O., Sioux Falls, S. D., and Newport News, Va., are getting in line with motor fire apparatus, bids having been asked on various items of equipment. In Johnstown, Penn., Painesville, O., Monterey, Cal., and other cities, motor equipment is being discussed and will probably be purchased in the near future.

BIDS ASKED ON AERIAL TRUCK.

Sioux Falls, S. D., has called for bids for an aerial fire truck which is expected to cost in the neighborhood of $10,000. The purchase has been contemplated for some time, as the present apparatus has been found ineffective in certain fires in the business section.

PARADE AT MEDFORD, MASS.

On Nov. 26 the complete motorization of the Medford, Mass., fire department was celebrated by a parade of the motor apparatus through the principal streets. The equipment is said to have cost the city $25,000.

IMPROVEMENTS FOR ELMIRA, N. Y.

The fire department of Elmira, N. Y., has been considering the purchase of motor apparatus, and it is expected that the matter will be presented at a special election, on the initiative of the fire wardens.

METROPOLIS TO SPEND $308,000.

The board of estimate and apportionment of New York City has voted a corporate stock issue of $308,000 for the purchase of motor apparatus for the fire department, according to the Fireman's Herald.

BOND ISSUE IN KOKOMO.

A bond issue of $15,000 may be put out by the city of Kokomo, Ind., to provide funds for the purchase of motor fire fighting equipment.

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THE A B C OF MOTOR TRUCK IGNITION.

Part XXIX—The Model AX Splitdorf Magneto, Affording a Low-Tension Current Which Is Intensified by a Transformer Coil—The Instrument Differs from Other Types in That the Collecting Brush Is Located at the Driving End.

By C. P. Shattuck.

ONE of the latest types of magnetos, an instrument that is highly developed, is the model AX, produced by the Splitdorf Electrical Company, Newark, N. J., whose products are well and favorably known to the automobile industry.

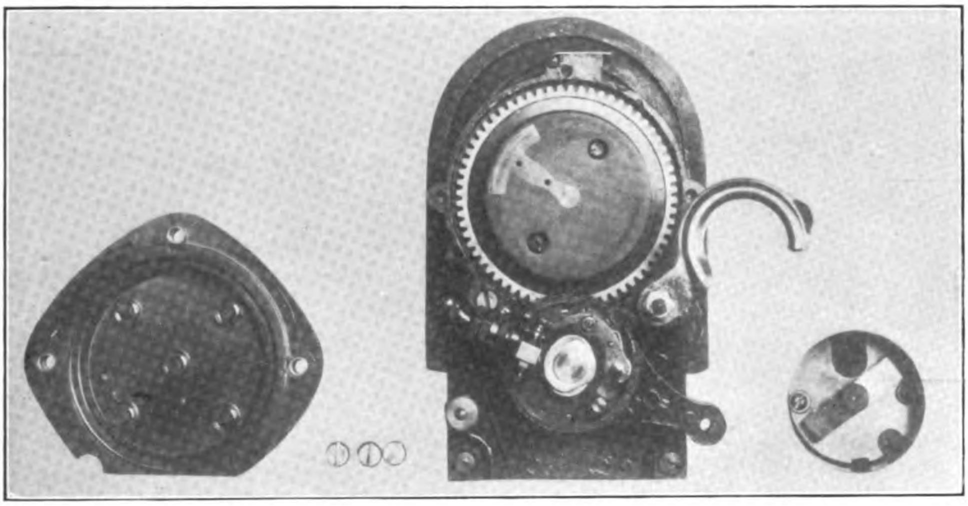

Fig. 181—The Distributor Block and Breaker Box Cover Displaced to Show the Arrangements of These Components.

This magneto is particularly adapted to the requirements of the motor of the commercial vehicle in that it provides dual ignition with one set of spark plugs. Another advantage is that an intensely hot spark is obtained at slow cranking speeds, as the current supply for starting purposes is provided by dry cells or a storage battery.

The model AX is a low-tension magneto; that is, it produces a primary current, which is intensified or strengthened by means of a transformer, a separate unit, which is also utilized to intensify the battery current. As is generally true with the low-tension magneto, the Splitdorf instrument can be utilized to start the motor with the energy supplied by the magneto itself.

While the model AX differs slightly from former types marketed by the Splitdorf Electrical Company, its construction and operation are similar to the earlier models. The production of the low-tension current is obtained by the rotation of the armature in a magnetic field, and but one winding (coarse or primary wire), is employed.

The new Splitdorf magneto differs from the types described in this serial, in that the device for collecting the current is located at the driving end of the instrument, as may be noted by reference to Fig. 182, which shows the collector brush holder. This member is provided with a terminal to which is attached the wire conveying the low-tension current to the transformer coil.

Located on the driving end of the armature and directly under the collector brush holder is what is termed the collector spool. In contact with this spool is a brush, the tension of which is regulated by a spring.

The mechanism utilized for interrupting the prim-

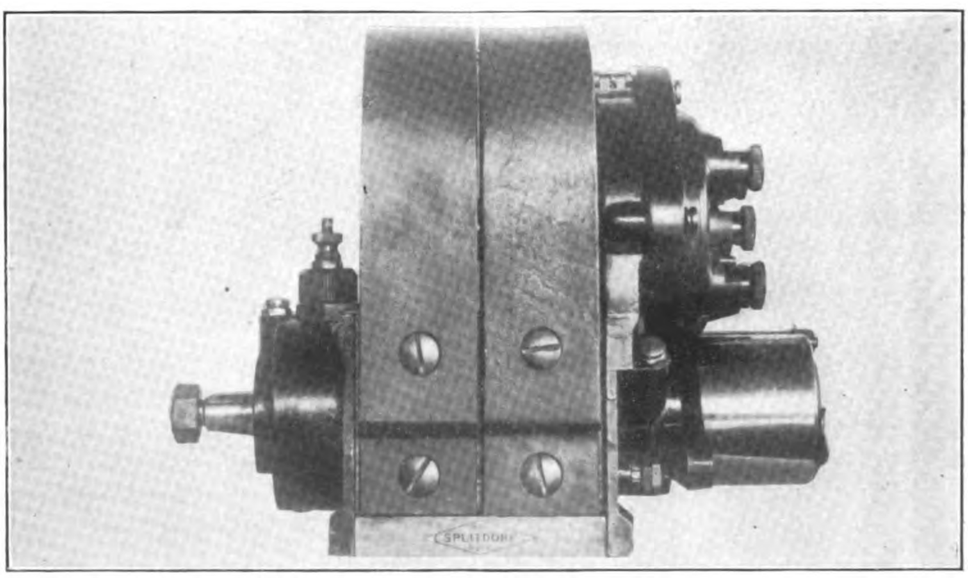

Fig. 182—The Model AX Splitdorf Magneto, Employing a Transformer Coil for Intensifying the Low-Tension Current—The Design Differs from Previous Models in That Current Is Collected at the Driving End.

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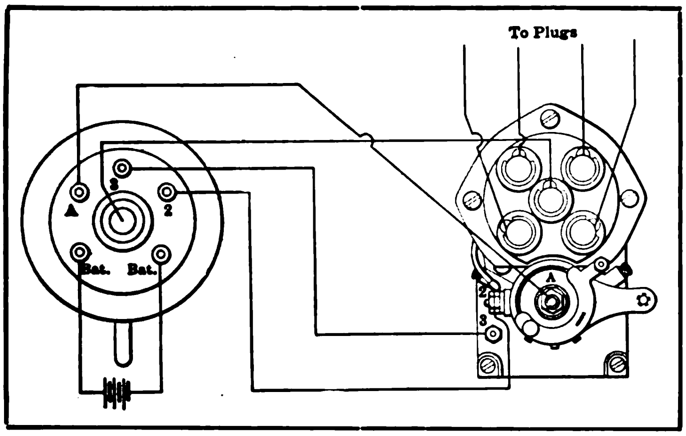

Fig. 183—Wiring Plan of Model A Splitdorf Magneto, Which Is Similar to That Utilized with the AX Type, with the Exception That the Wire Leading to A on the Magneto Is Connected to the Brush Holder at the Driving End.

ary current is shown at Fig. 181, which depicts the breaker box cover and distributor block or plate displaced. The breaker box is movable; that is, its lever may be moved through a range of 34 degrees, affording an advance or retard of 17 degrees, respectively, from a horizontal position, as shown at Fig. 184.

Pivotally mounted in the breaker box is the breaker bar, which carries a roller, also the fixed platinum contact screw. This screw contacts with a similar member, which is stationary in the breaker box. The fixed platinum contact screw is insulated from the body of the magneto and is of the adjustable type, it being possible to move it to a closer relation with the fixed member. This construction follows conventional magneto practise.

Interrupter Mechanism.

The interruption of the primary current, or separation of the platinum contact points, is obtained by a cam attached to the end of the armature shaft, and which rotates with it. Upon the cam contacting with the roller, as shown at Fig. 182, the roller and breaker bar, to which is attached the fixed platinum contact point, moves outward, breaking the contact. Normally, these points are held in contact by means of a spring, and when in touch with each other the path of the primary circuit is completed.

The cam actuates the breaker roller twice every complete revolution of the armature shaft, and two sparks are provided. The model AX magneto is driven at crankshaft speed for four-cylinder, four-cycle motors.

The distribution of the intensified current to the spark plugs of the motor is obtained by a metal segment mounted in the distributor disc, and this disc is a non-conductor of electricity. The segment is shown at Fig. 181 and, as may be noted, is flush with the surface of the disc. The last-named member carries what is termed the distributor gear, which is in mesh with a gear on the armature shaft. The distributor gear makes one revolution to two of the shaft gear, this ratio of drive being necessary, as has been explained in previous articles describing the timing of the spark.

The intensifying of the primary current is performed by the transformer coil. The current is collected by the brush in contact with the collector spool, and is led to the transformer coil where, when the primary circuit is interrupted, it is intensified. The electricity then flows from the coil to the centre terminal and its brush on the distributor block. This brush is in contact with the metal segment and, when the disc is revolved, contact is made with the four other brushes. These brushes are connected with the terminals to which the cables leading to the spark plugs are attached and, at each contact between the segment and a brush, the high-tension current passes to a spark plug.

Wiring Plan.

The wiring plan of the dual system is shown at Fig. 183, and in the drawing the cable carrying the intensified current is shown attached to the terminal A. With the AX instrument, however, the wire is connected at the terminal on the driving end of the instrument.

As may be noted, both leads from the battery are connected to the transformer coil, and neither is grounded. The grounding or diverting of the primary current, as when it is desired to stop the operation of the motor, is accomplished by the switch, which so changes the path of the current that it does not pass through the windings of the coil. The last-named member is the Splitdorf "T S F" transformer, which is mounted on the dash board and is of the flush type.

Provision is made for starting on the switch, the depressing of a button permitting cutting in the battery current. The coil is equipped with a lock having a removable key.

One of the advantages of the model AX magneto is that its direction of drive may be changed; that is,

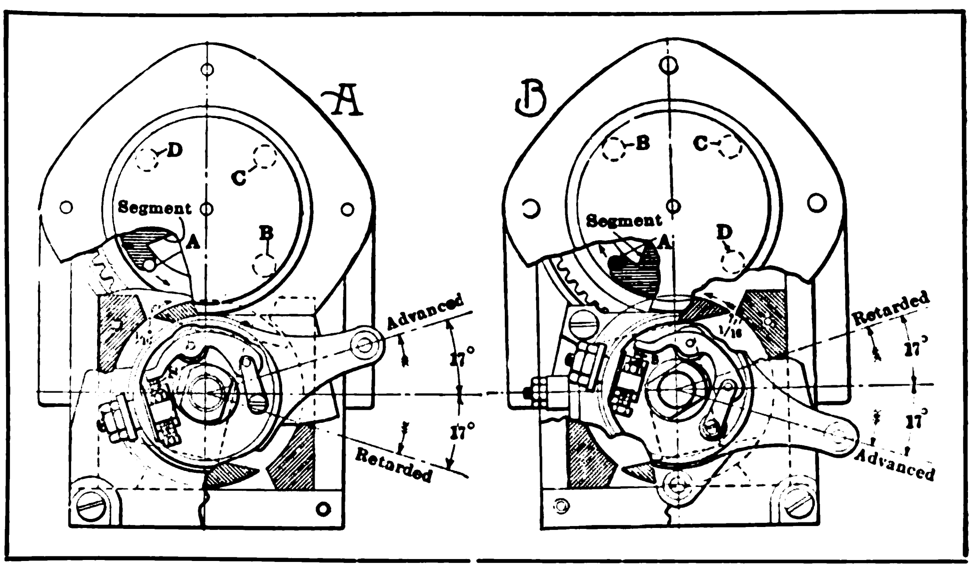

Fig. 184—Showing How Direction of Drive of Splitdorf Model AX Magneto May Be Changed—A Illustrates Left Hand and B Right Hand Instrument.

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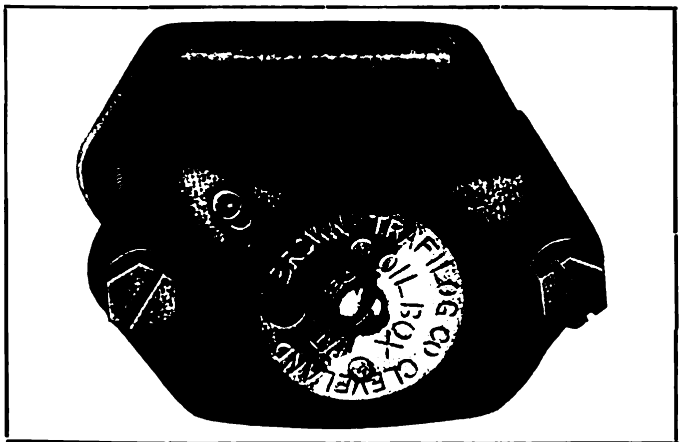
an instrument assembled for clockwise rotation of the armature shaft can be changed to anti-clockwise or vice versa. This is accomplished by displacing the nut retaining the cam, removing the cam and turning it over before replacing. The work also involves removing the disc carrying the large gear and replacing it so that the position of its segment will correspond with either A or B of Fig. 184.

The model AX Splitdorf magneto conforms to the S. A. E. standards of measurement, and has a shaft of 5¾ degrees taper. All breaker parts of the models A, AW and AX are interchangeable throughout.

(To Be Continued.)

BROWN OIL BOX FOR SPRINGS.

The Brown Trafilog Company, Cleveland, O., is marketing the Brown oil box, shown herewith, which is a compact device for automatically providing motor vehicle springs with a supply of lubricant. The oil box bolts on to the springs, just inside of the rebound clips, and contains two heavy felt pads, which retain the oil. The lubricant is fed by capillary attraction,

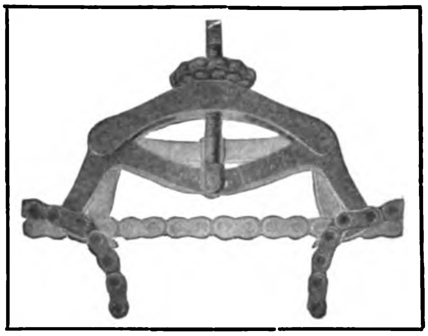


Brown Oil Box, a Device for Lubricating and Cleaning Springs.

and the feathering action of the springs forces the oil the entire length of the leaves, displacing rust and polishing the metal. It is stated that after installation the oil box requires no attention other than occasionally renewing the supply of lubricant. One of the features of the device is that it may be fitted with an ordinary screw driver.

HANDY SPROCKET CLAMP.

The Racine Auto Specialty Sales Company, 826 Consumers' building, Chicago, Ill., is introducing the Handy sprocket chain clamp shown in the accompanying illustration. It is a practical and useful tool for drawing together the ends of the driving chains when replacing these members after cleaning or breakage of a link. The tool is very compact, and with it the ends of the largest chain can be drawn together and the master or new link inserted in quick time. As may be noted by the illustration, jaws are provided for gripping the ends of the chain, which are drawn together by a toggle construction which is actuated by a threaded bolt in the linkage. The Handy sprocket chain clamp is very compact, and is a valuable addition to the tool kit, as with it broken chains may be replaced on the road, as well as in the service station. It is inexpensive. Prices and details will be supplied by addressing department E of the Racine Auto Specialty Sales Company.



The Handy Sprocket Chain Clamp.

INSURANCE ECONOMY.

The National Board of Fire Underwriters has approved the one-quart Pyrene fire extinguisher marketed by the Pyrene Company of New England, 88 Broad street, Boston, Mass., and equipping machines with it obtains a reduction of 15 per cent. in the cost of the premium of the fire insurance policy. The Pyrene fire extinguisher is very compact and efficient and not only is it approved by the insurance companies, but by the Safety First Society. It is moderately priced.

NEW LINE DOES A GOOD BUSINESS.

The recently started 'bus line between Summit and New Providence, N. J., is proving very successful. The fare from West Summit is five cents, if book tickets containing 20 rides are purchased.

"X" RADIATOR LIQUID.

The "X" Laboratories, room 9, 630 Washington street, Boston, is marketing the "X" liquid, a radiator medicine that is stated to be very efficient in repairing leaks in the cooling system of a motor vehicle. It differs from the usual compounds in that it is a liquid which, the maker states, cannot clog the radiator. A feature of the preparation is that it may be utilized in the cooling system with any anti-freezing solution, and another advantage is that being left in the radiator any leaks that may develop are automatically repaired. It is stated that it will prevent corrosion or pitting of the tubes. The "X" liquid is inexpensive. Prices and folder describing its properties will be supplied upon addressing the maker.

"X" Liquid, for Repairing Leaks in Radiators.

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RUBBER EMBARGO LIFTED.

No Probability of Increased Prices Is the Statement of Goodyear Company.

The effect of the embargo placed on crude rubber by England upon the tire industry has been disturbing because of the uncertainty as to the future, and the users of tires have been particularly apprehensive that they would have to pay considerably increased prices, if they did not have difficulty in obtaining shoes. The decision of England to raise this embargo on all American tire manufacturers who can or will comply with the conditions made by Great Britain, has entirely changed the situation, and there will be decided interest in the following statement, made by P. W. Litchfield, factory manager for the Goodyear Tire and Rubber Company, Akron, O.:

"The rubber embargo by Great Britain, after being in force for nearly two months, has been raised on all concerns who have guaranteed not to re-export rubber to the enemies of Great Britain. The Goodyear Tire and Rubber Company has not been inconvenienced by this embargo. Anticipating possible disturbance owing to the war, we endeavored to carry larger stocks than usual, and have had more rubber at our factory at Akron during the embargo than we ever had before.

"The factory production for November was 20 per cent. greater than last November, and the factory production for December was 33 per cent. greater than for last December. During the embargo our rubber has been coming into Canada and stored at Toronto, and we now have more than 1000 tons of crude plantation rubber in storage there which we are making arrangements to have shipped to us at once, and which will arrive long before our present supply in Akron is exhausted".

The inference from the above statement is that any commercial dangers that might have been anticipated are now dissipated, and there is remote probability of advance in prices, while the prices of crude rubber are gradually dropping to the level of the beginning of the war. During the period the embargo was effective the prices of rubber nearly doubled. The Goodyear Company, having brought its large stock into Canada, will be, it is believed, the first company to receive raw material as a result of the lifting of the embargo.

The Wisconsin supreme court has held that the city cannot be held as liable for damages in personal injury actions, based on accidents caused by the vehicles of the police or fire departments.

An ordinance reducing the permissable speed of motor trucks from 15 to nine miles per hour is under consideration by the board of aldermen of New York City.

PACKARD ADOPTS WORM DRIVE.

Will Build Series of Six New Machines, One to Six Tons Capacities.

Statement is made by the Packard Motor Car Company, Detroit, Mich., that it has adopted designs for a series of six trucks, with capacities of one, two, three, four, five and six tons, which will differ from the present design in that they will be driven by worm and gear wheel systems of power transmission. The rear axles will be full floating, of the top-worm type, and another feature will be the use of the same control system found very efficient with Packard pleasure cars.

The machines, while they will have the same general characteristics, will not be constructed to a standard design, and each will differ slightly from the others. The 2000-pound machine will be the lightest vehicle in load capacity that the company has constructed.

The motors will be block four-cylinder, L head designs, which are new types with Packard engineers, and another feature will be automatic governor control, this being independent of the regulation of the fuel supply. The motors will also be fitted with power take-offs, so that power hoists or other special equipment can be fitted and driven from the motors. The power plants are mounted on three points and special provision is made for protecting the radiators against stresses from chassis distortion.

Of these machines that of two-ton capacity will have a motor with bore of four by 5½ inches, rated by the S. A. E. formula at 25.6 horsepower, and the three and four-ton chassis will have the same size motor, with bore of 4½ inches and stroke of 5½ inches, with rating of 32.4 horsepower. The motors will have four bearings for the crankshafts and camshafts, and are said to be particularly accessible.

The clutch is a multiple dry disc construction, and the gearset is a progressive type with three forward speeds and reverse, operated by a lever at the left side of the chassis. Provision is made for starting the engine and lighting electrically. The experimental work with these designs has extended over a period of three years and extreme care has been given to insuring simplified and long enduring construction. Unusual attention has been directed to lubrication, both of the motor and the chassis. The wheelbase of the 4000-pound machine is 144 or 168 inches, and of the 6000 and 8000-pound machines either 156 or 180 inches. The details of these machines have not as yet been announced.

New agencies for the Koehler one-ton wagon include the Miller-Main Garage, Columbus, O.; W. E. Sparkes, Los Angeles, Cal.; Monson Garage, Monson, Mass., and the Ansonia Garage, Ansonia, Conn.

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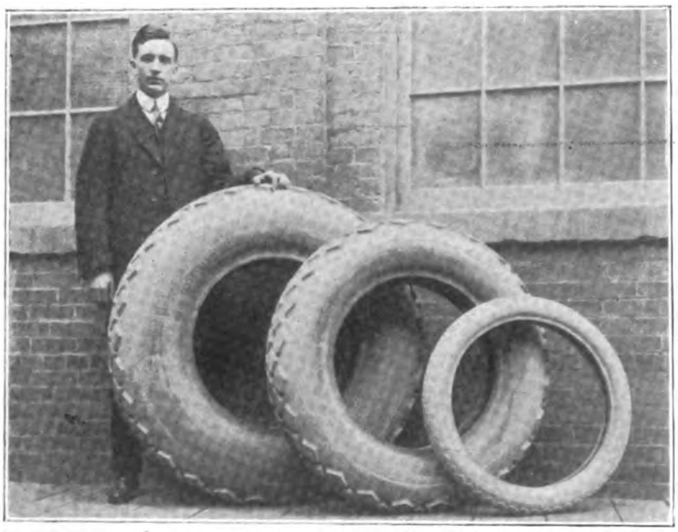
GIANT PNEUMATIC TIRES.

Goodyear Company Producing Three Types Designed for Truck Service.

What are undoubtedly the largest pneumatic tires ever made in the world for practical use are now being built by the Goodyear Tire and Rubber Company at its factory at Akron, O., these being mammoths when compared with regular types of standard sizes, and they are in service in a number of the principal cities, for the desire is to thoroughly test them in normal work in comparison with the solid shoes.

More than a year ago the company began the production of these large tires, intended wholly for truck use, and some of them have been used since last March with a large measure of success. Not one of these has worn to such a degree that its usefulness has ended, and several have been driven more than 6000 miles.



Goodyear 48 by 12-Inch and 42 by Nine-Inch Pneumatic Truck Tires, Compared with a Standard 30 by 3½-Inch Pleasure Car Shoe.

The tires have been built in three sizes, 38 by seven inches, having a rated carrying capacity of 2500 pounds; 42 by nine inches, having a capacity of 4500 pounds, and 48 by 12 inches, with capacity of 7500 pounds.

These tires are built in the No-Rim-Cut type, and conform to the Goodyear ideal detachable rim, '07 profile, so that they are, save in size, number of plies of fabric, etc., identical with the tires made for pleasure cars in use, installation and removal. Very heavy tubes are made for use with these shoes, that for the 42 by nine-inch size weighing about 30 pounds.

The 38 by seven-inch size replaces the 36 by 4½ or 37 by five-inch dual equipment, and the statement is made that these have been found to give excellent results, having great resiliency and easy riding qualities and durability not found with the smaller shoes. The 38 by seven-inch size has nine plies of 20-ounce fabric, and the 42 by nine-inch size has 11 plies. The sizes of these shoes are best realized when noted in the accompanying illustration, the 48 by 12 and the 42 by nine-inch sizes being shown with a 30 by 3½-inch regular tire, the larger with a tall man beside it. The Goodyear Company states that there is a constantly increasing demand for these sizes, and there is probability that they will be built as standard production.

FEDERAL COMPANY SHARES PROFITS.

The Federal Motor Truck Company, Detroit, Mich., on Dec. 24 distributed to its employees Christmas presents in the form of checks equal to 10 per cent. of the salaries received by them during 1914, these being given as their share of the profits of the company.

Vice President and General Manager Martin L. Pulcher made a short talk to the employees, stating the result of the company's profit sharing plan, and making an earnest appeal for co-operation of all the shops and departments for the year to come. He stated that the company was distributing an amount in excess of $10,000, that there was only one concern in Detroit doing as much for its employees, and that the company hoped to do as much or more for the employees the next year. There was a little banquet given for the employees of the general offices as well.

The statement is made by the company that the enthusiasm and the greater efficiency of the entire organization through the past year has proven the Federal policy of rewarding loyalty and conscientious work, and there is reason to believe that the results will increase each year.

NEW SERVICE STATION.

The Autocar Sales Company, now located at 435 West 19th street, New York City, will, about Feb. 1, remove to a building formerly used by United States Express Company, with entrances from West 23rd and West 24th streets, between 10th and 11th avenues. This building is now being reconstructed for the service station of the company and it will have a garage with floor space of 75 by 175 feet. The entire building will be used by the station, which will be the largest and best maintained by the company.

E. E. Wallace, for five years in charge of the service department of the electric division of the General Vehicle Company in the New England district, with headquarters at Boston, Mass., has been added to the sales force of the company and will work in the same district under the direction of Day Baker, the New England district manager.

The motor driven vehicles belonging to the city of Houston, Tex., are to be cared for in a municipal garage, $1750 having been appropriated by the city council for that purpose.

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MOTOR TRUCK CLUB AN OWNERS' ORGANIZATION.

TRANSLATION from what was regarded by many as an industrial and trade organization, to what must be recognized as an owners' association, was accomplished at the annual meeting of the Motor Truck Club of America, held at the Automobile Club of America, New York City, the evening of Dec. 16. This was decidedly important, because the activities of the club will be directed by owners and their representatives, and endeavor will be made to encourage the organization of similar clubs in all parts of the United States, with the primary object of promoting the interests of all engaged in highway vehicle transportation, but especially those utilizing motor trucks.

Invitation has been extended to clubs and associations with similar purpose in all parts of the country to co-operate, and to organize a national association, with the expectation that owners of motor trucks and wagons will take active part in what will directly benefit them. A systematic campaign will be conducted that will, no doubt, demonstrate the possibilities of co-operation, and which will materially increase the membership.

The club was organized by representatives of manufacturers and agents for motor trucks on the broad basis of promoting and protecting the interests of motor vehicle owners, and the activities of the body were so directed as to bring to the attention of municipal, state and even national administrations the economies practical through systematic control of highway transportation. The club sought co-operation, and endeavored by well conceived and directed educational work to interest influential bodies, and this was so successful that a large number of owners and representatives of owners of large installations affiliated themselves with it.

The club members worked in harmony with other associations to discourage proposals for state and municipal regulation and taxation that would be inimical to vehicle owners of all kinds, and encouraged propositions that would result in economies and better protection of the people as a whole. The club has been recognized as a progressive body, directed by broad minded men, who are considerate of the rights and welfare of others, and as such it has acquired a very large degree of influence, not only in New York and vicinity, but throughout the country.

The policy of the club has been consistent. While founded by men directly interested in the motor vehicle industry and trade, who gave their active and substantial support until a sufficiently sound basis was created and the interest of owners assured, these men have not sought to promote their personal interests, and now that the club is controlled by owners they will just as actively support it as they have in the past. In other words, having developed the club to a condition where the owners of motor vehicles understand and realize the benefits of membership, they are desirous of continuing their activities, not for industrial or trade preference, but as individuals who believe in and have the fullest confidence in the economies of motor vehicles for highway haulage.

The annual meeting was preceded by a dinner, which was enjoyed by a large number. The annual reports of President George H. Duck, Secretary Ellis L. Howland and Treasurer Morris R. Machol were presented, that of President Duck referring to the activities of the club during the year, and that of Secretary Howland dealing more with statistics. This statement showed that the membership was 344 against 255 for the previous year; that during the year 127 had been elected members and 38 had resigned or retired, this being a net gain of 89. The membership of the club is made up as follows: Truck manufacturers, 35; truck manufacturers' branch representatives, 20; motor truck dealers, 20; motor truck salesmen, 18; parts makers, 19; body builders, 19; accessory dealers, 21; battery manufacturers, 9; tire manufacturers, 15; tire salesmen, 9; mechanical engineers, 8; advertising companies, 6; garage owners, 5; motor truck owners, 91; motor vehicle schools, 2; associations, 7; insurance agencies, 3; press representatives, 41.

During the year the club held 12 meetings and the directors met 14 times, and there were two meetings for social intercourse. The club has planned the organization of branches in Newark, N. J., Philadelphia, Buffalo, Syracuse, Chicago, Los Angeles and other cities. The different committees have been active in the promotive and educational work.

The election of officers was as follows: President, T. D. Pratt, Central Stamping Company, Newark, N. J.; first vice president, George H. Pride, Heavy Haulage Company, New York City; second vice president, George Stevens, Adams Express Company, New York City; third vice president, Winthrop Waite, Packard Motor Car Company of New York, New York City; secretary, F. Nelson Carle, General Vehicle Company, New York City; treasurer, R. T. Allcutt, Knox Motors Company, New York City; directors (for three years), B. T. Kearns, Central Brewing Company, New York City; Charles W. Fletcher, Walter Motor Truck Company, New York City; George H. Duck, Sewell Cushion Wheel Company, New York City; C. B. Warren, General Motors Truck Company, New York City; (for two years), C. W. Blackman, the Commercial Vehicle, New York City; Nathaniel Mallouf, Harrolds Motor Car Company, New York City. These directors, with H. P. Cavarly, National Lead Company; Emanual Lascaris, DeDion-Bouton Company; J. W. Perry, Lippard-Stewart Motor Sales Company; Frank W. Smith, United Electric Light and Power Company; David C. Fenner, General Vehicle Company, and Roderick Stephens, Olin J. Stephens, Inc., constitute the board.

Following the business session an interesting ad-

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dress was made by H. M. Swetland, president of the Class Journal Publishing Company, whose subject was the motor truck industry, what it was industrially to the country, what economies were possible and practical, and the enormous and enduring benefits that would obtain to the country as a whole through improvement of highway transportation.

CUTS COST OF NON-FLUID OIL.

As the result of improved manufacturing facilities and largely increased business during 1914, the New York & New Jersey Lubricant Company, New York City, has been enabled to reduce the price of its Non-Fluid oil. The company, however, has not decreased the high quality of its product, and will maintain the same standard of excellence that it has held in the industry for the past 15 years.

For the motorist who is looking for a high-grade oil, it would be advantageous to get the benefit of the company's free sample offer. Write the New York & New Jersey Lubricant Company, 165 Broadway, New York City, and ask for sample cans of "K-No. 00 Special", and "K-No. 000" grades of Non-Fluid oil. Both will be sent gratis to any address.

DECEMBER ALBATROSS.

The White Company, Cleveland, O., builder of White trucks, publishes monthly a magazine entitled the Albatross, which is devoted to the dissemination of information of its extensive organization throughout the country. The publication is naturally given over to facts that concern and interest the selling force, but the December edition is of more than usual interest from the fact that it is made up exclusively of facts relative to the use of White motor trucks for general purposes and White municipal equipment.

NEW SIGNAL TRUCK AGENTS.

The Signal Motor Truck Company, Detroit, Mich., has established the following agencies: Henderson Brothers, North Cambridge, Mass.; W. L. Huffman Automobile Company, Omaha, Neb.; Stewart Motor Truck Company, Pittsburg, Penn.; Signal Truck Company, Atlanta, Ga., and the Signal Truck Company, Spokane, Wash.

LIABLE FOR FRIGHTENING HORSES.

According to a recent decision of the supreme court of Minnesota, the driver of a motor vehicle is bound to slow up when he sees that horses are frightened, even if no signal is given him, and if he fails to do so, will be liable for any damage which may result.

Five 1000-pound parcel post motor wagons have been installed at the Cleveland, O., postoffice.

MASSACHUSETTS MOTOR TRUCKS.

The number of motor trucks in Massachusetts has increased over 100 per cent. during the past two years, and the total today is 8236. A summary of the comparative figures for the past three years follows:

Year	Vehicles	Receipts	Increased Vehicles	Increased Receipts
1914	8236	$41,180	2288	$11,400
1913	5948	29,740	1861	9,305
1912	4087	20,435	*——	*——

*Figures not available.

AMERICAN TRUCKS PROTESTED.

The Montreal Automobile Trade Association, Montreal, Canada, in a protest to the prime minister of Canada, caused the recommendation of the second purchase of American trucks to be quashed. A committee had been selected to designate trucks for the war department and, after recommending American trucks only for both the first and second contingent, a protest was made. There were 65 trucks in the first order and 42 armored trucks in the second.

CANADA TO MAKE ARMORED TRUCKS.

The Russell Motor Car Company, Toronto, Canada, is to make armored trucks for the Dominion government. Major-General Hughes, after inspecting a model car recently, confirmed an order for 40 machines. This is made up of 20 cars comprised in the offer of J. C. Eaton, a Toronto citizen, to equip a motor machine gun battery, and in addition 20 cars to be ordered by the government.

WILL SAVE ON GASOLINE.

By the installation of a 10,000-gallon tank, permitting purchases in car load lots, Fred H. Clark, superintendent of the department of streets and engineering, Springfield, Mass., hopes to save $500 a year on the fuel consumed by the 18 automobiles under his supervision. The other city departments will also be supplied at cost, plus 10 per cent. for handling.

The Universal Tractor Manufacturing Company, Columbus, O., has issued a very complete catalogue describing and illustrating the Universal motor cultivator, which can be used for cultivation, hauling farming implements, planting and as a small power plant. The machine is driven by a water cooled, two-cylinder motor.

The fourth annual motor vehicle show of the Pittsburg Show Association of Pittsburg, Penn., will be held early in February. A representative truck exhibit is being arranged in addition to the passenger vehicle section.

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NEWS OF THE MANUFACTURER.

The Ward Motor Vehicle Company, Mount Vernon, N. Y., has completed the construction of its new plant in that city. The new building is one story high and is 162 feet wide by 302 long. The general offices of the company will be located in Mount Vernon, and a show room has been opened recently at 101 Park avenue, New York City. The former plant of the Ward Company in the Bronx, at 143rd street, is being vacated and the machinery and equipment is being transferred to the Mount Vernon site. A private freight siding runs into the stock room at the new plant and then down aisles 40 feet wide and 250 feet long. This enables materials to be delivered direct from the freight cars to the different departments.

C. W. Brown, formerly on the sales force of the San Francisco, Cal., branch of the Firestone Tire and Rubber Company, Akron, O., has been made manager of the company's Seattle, Wash., branch.

The Chester County Motor Company, Coatesville, Penn., has increased its capital stock to $500,000 and plans the erection of a large factory to be used for the manufacture of motor trucks.

Otis R. Cook, general sales manager of the Kelly-Springfield Tire Company, New York City, has left for the Pacific Coast, to be gone one month. He will devote his time to plans providing for the increasing business of the Kelly-Springfield Company in that section.

The Service Motor Truck Company, Wabash, Ind., is the new name of the Service Motor Car Company of that city.

C. H. Gleason, formerly connected with the sales department of the Sheldon Axle Company, Wilkes-Barre, Penn., has joined the sales and designing force of the Kalamazoo Spring and Axle Company, Kalamazoo, Mich.

The Goodyear Tire and Rubber Company's New York headquarters have been moved from Broadway and 67th street to its large warehouse and service station, Long Island City. The company sells at wholesale only, but will continue to maintain a branch service in Manhattan.

A. R. Miller, who has had the management of the motor truck trailer department of the Troy Wagon Works, Troy, O., has been placed in charge of the farm and dump wagon sales of the company, in addition to his former duties. Mr. Miller will be located in the Hammond building, Detroit, Mich.

The Atwater Kent Manufacturing Works, Philadelphia, Penn., has broken ground for an addition to its plant in that city. When it is completed the new addition will increase the floor area by more than 100 per cent.

H. R. Rasmussen, well known through his connection with the Alvan T. Fuller Company, Boston, Mass., agent for the Packard Motor Car Company, Detroit, Mich., has been transferred to the Providence branch of the Fuller Company.

Weller & Thomas, Zanesville, O., has prepared plans for a motor truck factory to be erected in Columbus, O. The new building will be two stories high, made of brick and will cover a plot 100 by 190 feet.

Winfield Jewell has been made retail sales manager of the New York branch of the Studebaker Corporation, Detroit, Mich.

The Gould Storage Battery Company's Detroit, Mich., office has been moved to the Kerr building, 100 Beaubien street, that city.

C. A. Jessup has been appointed southern district sales manager for the Kelly-Springfield Tire Company, New York City, with headquarters in Los Angeles, Cal.

C. C. Homan, recently general purchasing agent of the Willys-Overland Company, Toledo, O., has been made special sales representative of the Detroit, Mich., branch of the Gould Storage Battery Company, New York City.

C. H. Smith, advertising and publicity manager of the Moreland Motor Truck Company, Los Angeles, Cal., is recovering from an operation performed at the California hospital, that city.

The Wilson Tire and Rubber Company, Springfield, Ill., has advanced the price of its common stock from $10 to $12.50 a share. The new factory of the company in Harvard Park is just about completed and most of the machinery has been installed.

Joseph A. Hussion, formerly of the Knox Motors Company, Springfield, Mass., has joined the sales department of the General Vehicle Company, Long Island City, N. Y.

W. K. Ackerman has retired as secretary of the Standard Motor Truck Company, Detroit, Mich., but retains his stock in the company.

The Edison Storage Battery Company, Orange, N. J., announces the appointment of William F. Bauer as manager of the Chicago, Ill., office, succeeding Charles B. Frayer, resigned. Mr. Bauer has been with the Edison Company for the past year as assistant manager of the railway department. He is president of the Railway Electrical Supply Manufacturers' Association, and a pioneer in the storage battery field in Chicago, where, in 1906, he was sales manager of the Electric Storage Battery Company.

The White Company, Cleveland, O., announces the appointment of Charles R. Porter, as manager of the St. Louis, Mo., branch of that company, succeeding H. M. Rosenberg, resigned. Mr. Porter was formerly identified with the A. O. Smith Company, Milwaukee, Wis., and then with the Garford Company, first at its plant and later as manager of its truck sales department in St. Louis.

L. E. Harmon has formed a company in Cambridge, Mass., to handle the Atterbury truck in New England. Sales rooms and a service station have been opened at 159 Vassar street, that city. Mr. Harmon has been connected with the Atterbury Company for over a year.

The Packard Motor Car Company of Paris, France, has donated five Packard ambulances for war service. These are for Red Cross purposes between the firing line in Flanders and the field hospitals which serve as relief stations between the military bases. These cars are operating under the direct control of the military authorities and are succoring the wounded of both the Triple Entente and the Dual Alliance.

Exterior View of New Plant of the McQuay-Norris Manufacturing Company, Maker of the Well Known Leak-Proof Piston Ring.

The Stewart-Warner Speedometer Corporation, Chicago, Ill., has issued a 56-page booklet entitled: "Making Your Motor Truck Pay". The importance of mileage and of the load carried by a motor truck are explained. Motor truck abuses are laid at the door of the owner who is inclined to believe that the fault lies in the truck when it fails to deliver goods more cheaply than horses, when in reality the trouble is in the manner in which the truck is operated. The booklet gives formulae for calculating the cost of motor truck operation and report forms upon which the cost data may be placed and reproduced. The Stewart hub odometer, tire pump, vacuum gasoline tank and the various Stewart-Warner speed indicators and meters are described and illustrated.

Donald Johnson has succeeded W. R. Johnston as Pacific Coast manager of the Stewart-Warner Speedometer Corporation, Chicago, Ill. Mr. Johnson was formerly a representative of the same company in Toronto, Canada.

The Overland-Garford Sales Company, Cleveland, O., has filed papers with the Ohio secretary of state whereby its name will be changed to the Overland-Cleveland Company.

Henry W. Gray has been appointed manager of the accessories department of the St. Louis, Mo., branch of the H. W. Johns-Manville Company, New York City.

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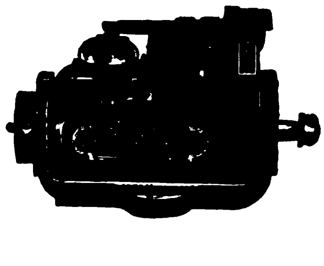

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Magneto

S. R. O. Ball Bearing

MARBURG BROS., Inc.
Sole Importers
Detroit NEW YORK Chicago

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., FEBRUARY, 1915 No. 2

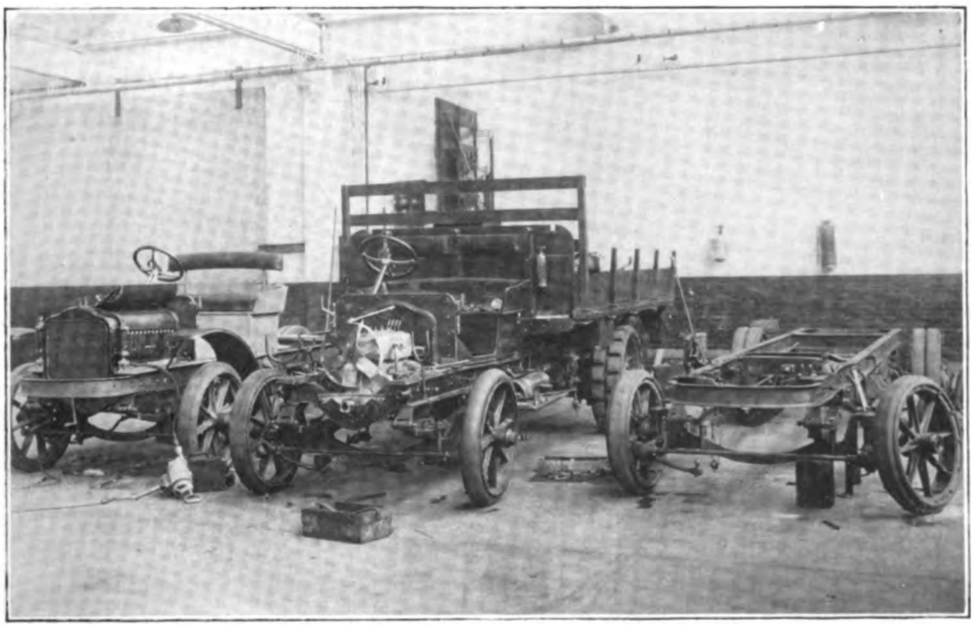
WHITE COMPANY SUPERVISES TRUCK USE.

Operates Its Own Service Stations with Methods Insuring Factory Production and Economy, and Has Developed a Nation-Wide Organization by Encouraging Garages and Repair Shops to Specialize White Vehicle Maintenance.

SERVICE is, from the viewpoint of the manufacturer of motor vehicles, a subject of prime importance. It is a business policy that must be well defined and consistently followed. From the viewpoint of the owner who realizes that the warranty covers defective material or faulty workmanship, and that he is responsible for the profitable or unprofitable use and for the ignorance, neglect or errors of his drivers, service means facilities for work and intelligent attention when either are necessary to continue operation.

There are those who assume the manufacturer or his representative ought to maintain a machine and practically insure its operation, no matter what the abuse or misuse. As a matter of fact there is no reason why any builder of vehicles should be responsible to any greater degree than a manufacturer of any machinery, but good judgment would dictate that in the event of need there be an efficient organization to restore serviceability and at the smallest expense compatible with the work.

The White Company, builder of White motor wagons and trucks, has a business policy that has developed for the benefit of owners of White vehicles a very certain means for maintenance. This applies outside of its numerous branches and agencies, and it is by encouraging garage and repair shop owners to specialize adjustment, care, repair and overhauling, so that in localities that are not directly served there is certainty that any necessary work can be done by men who have at least practical working knowledge, and, in many instances, may be regarded as experts with White trucks.



Section of the Repair Department of the Boston Service Station, Showing the Ample Space for the Workmen and the Splendid Lighting of the Floor.

The White service stations and agencies are admirably equipped and they are established in numerous commercial centres, but the White Company is convinced that the interests of the owners are best conserved by there being White specialists available wherever White machines are used. To illustrate this point statement may be made that the company has a New England branch in Boston, and agents in a number of the principal cities, but many garages and repair shops specialize work on White vehicles. The owners of these garages and shops are given every assistance that will improve the work they do; they will be advised on any sub-

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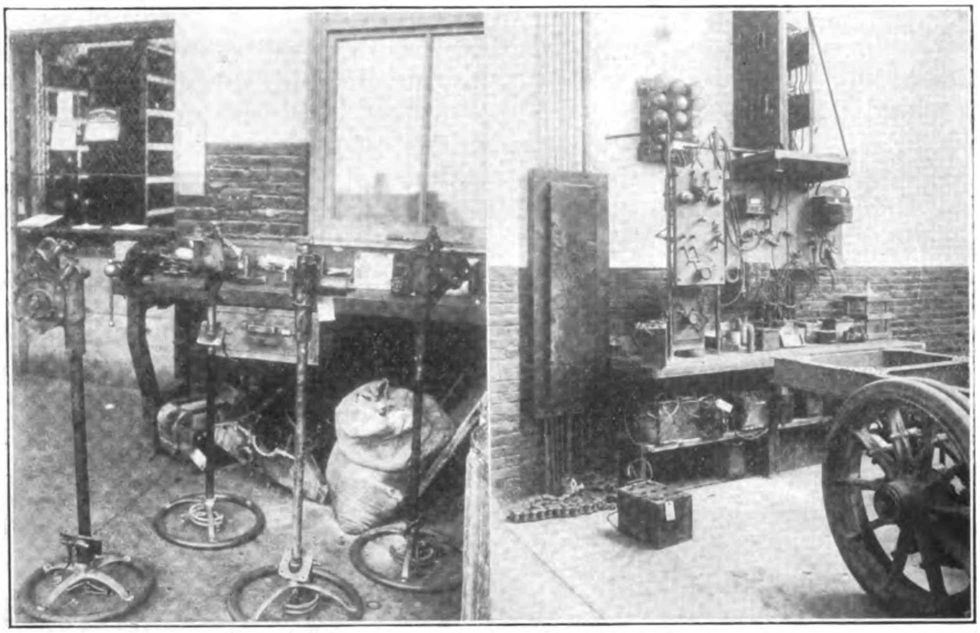
ject, even furnished with expert workmen for a job that requires special attention, and they can obtain parts at wholesale prices. The company desires that these men turn out work that is up to its own high standard, and will go to what may be regarded as an extreme to stimulate the interest of the shop owners and insure the quality of their work.

The company believes that those owning White trucks will distinctly benefit by the increase of these stations, and this organization is being perfected with the expectation that it will eventually include a White specialist in every city and town of importance. This means that there will be minimum loss of vehicle service time, the work will be well and quickly done, and the cost will be reasonable. The White truck owner will be certain that he will have adequate facilities for satisfactory maintenance.

The standard of work that the White Company approves is extremely high. In fact the statement that it is equal to factory production is thoroughly consistent. This is demonstrated at the service station of the New England branch, at Commonwealth avenue and Pleasant street, Brookline, where what is claimed to be the finest establishment of the kind in New England is maintained. This is used jointly for trucks and pleasure cars, the sales rooms and offices facing Commonwealth avenue, and the service building extending along Pleasant street for a block. The structure covers approximately an acre, is generally a single high story, well lighted by a saw-tooth roof, and the service station includes a pleasure car garage, repair department, and two sections that are used for storage of new cars and trucks. The building will shelter 150 vehicles without crowding.

The building is as near fireproof as science can produce, being constructed of brick, stone, cement, steel and metal, the only wood being the furniture of the offices and the benches in the service station. It is T shaped, with the arms representing the service station and the standard the sales room and offices. Very careful provision was made for lighting, heating, and the facilities for the different departments were determined with regard for high efficiency. There is one floor, no elevators, and labor is minimized in moving the vehicles, all being very accessible. The building was occupied in August, 1913.

There are two entrances for vehicles to the service station, the one at the side and the other at the rear, the latter affording egress to the private garage, which is at one end of the arms of the T. There is a storage room for vehicles at the other end, and between the two is the stock room and the station offices, and inside of these the service department workshop. The stock room is very large, having supplies of parts for all types of White pleasure cars and trucks ever built, together with the equipment components such as radiators, fenders, tires, wheels, etc. This department is maintained by the factory and a perpetual inventory is kept so that at any time the precise condition of the stock can be ascertained. There is an office for the stock room with a counter where customers can be served, there being an entrance to this with a passage between the office of the superintendent and the office of the station.



All the Work Is by Workmen Specially Trained: At Left Is the Department for Repairing Steering Gear; at Right the Battery Charging Switchboard of the Electrical Department.

The office of the superintendent is so located that practically every department of the station is visible from it. Above the offices is a recreation and locker room for the workmen, access to this being by a flight of stairs outside the building. From this a second flight descends to the floor of the workshop. Time is a very important factor in the station. The workmen are notified two minutes in advance the time for beginning work by a bell, this giving them opportunity to stamp their cards before starting. All the day and job time cards are clock-stamped, every minute thus being accounted for. The reason for time efficiency is that this is the only factor of cost that can be controlled, and for the benefit of the customers it is recorded with absolute accuracy.

The workshop is divided into two sections by a heavy wire grating. Within the grating is the machine shop, which is equipped with benches at either side and a line of machine tools, including lathes, drills, arbor presses, grinders and the like in the centre. Outside, along the grating, is another line of work benches. An overhead trolley with chain hoists

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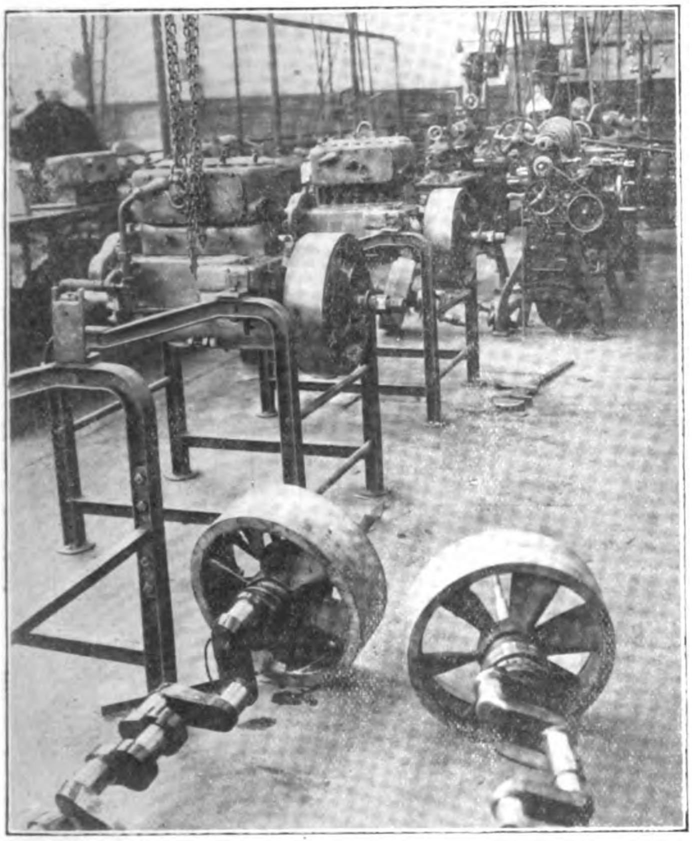


The Motor Department, Where the Engines Are Handled by Trolley Hoists, Showing Work in Progress and the Machine Tool Equipment.

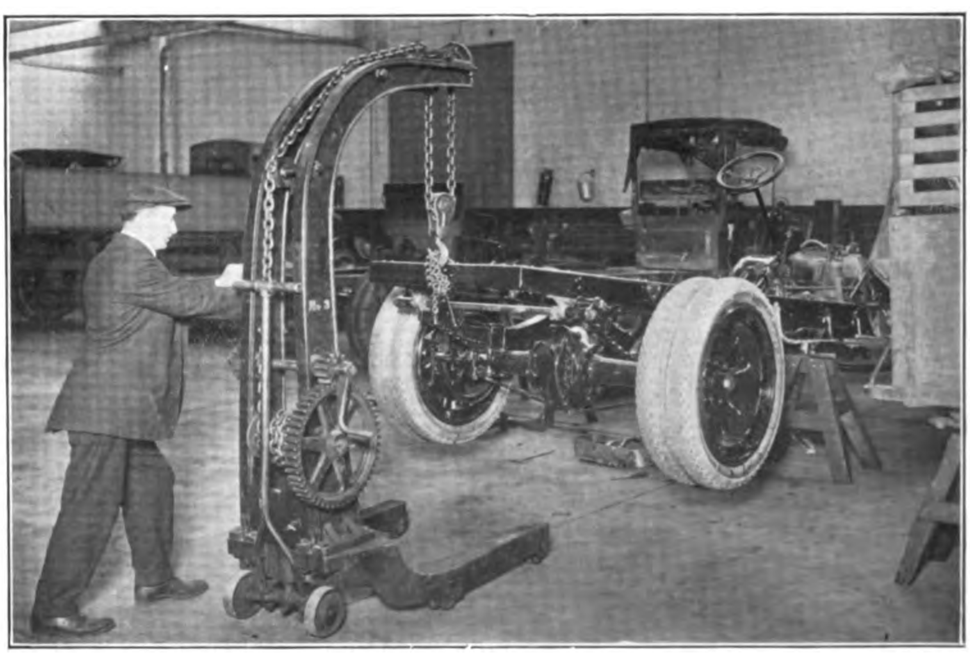
extends along the centre of the machine shop. Portable floors cranes are used to lift the motors, rear axles and the heavy units from the chassis, or to install them, and the motors are taken from the cranes and placed wherever desired by the trolley hoists in the machine room. The cranes are used to handle the axles at the outside benches, where they are worked on.

The working force of the shop is of experts, each man having to do with particular equipment. For instance, there is a carburetor man who adjusts and repairs the different carburetors, a man who repairs steering gears, another who gives his exclusive attention to rebuilding radiators, another who restores electric batteries and engine starters and lighting systems, and these men cannot only do work quickly, but they do unusually good work, two important considerations for a man who is paying the bills and seeks to economize. In the motor department the workmen are equally specialized, each having certain work, and the same is true of the men who work on the axles.

The machine tools are adapted for work that is not usually undertaken outside of factories, but in this shop cylinder blocks or units are re-bored, reamed and lapped and polished, this being a very large saving in the cost. The boring and reaming is done on the lathes with jigs built for the work, and the lapping is done on a drill press with tools designed specially for this process. The jobs turned out are equal to the new work from the factory. Wherever a saving can be made by special equipment it has been procured, and while expense of labor has been reduced the quality of the work has been consistently maintained.

Assuming an instance of work: When a machine is brought to the garage it is driven inside the door, where it is met by a clerk, who checks it for equipment, and after this record is made the machine is taken by the foreman of the repair department of the service station, who drives it into the shop. There are removable equipment is taken off and the different articles placed in a check room under lock and key. The machine is then taken in charge by the chief tester, who first tries it on the floor and later on the road, and makes a thorough examination of it.

Meantime an order or repair tag has been made out in duplicate, one of which is attached to the machine and the other is sent to the stock room. If the job is an overhaul the body is taken from the chassis before the tests and then the work is laid out by the assistant foremen of the four departments of the shop as it comes to them. The engine is taken out and removed to the machine shop, the wheels are taken off and the rear axle, the steering gear, the radiator, the transmission gearset, are all sent to the different specialists, and then the floor crew give attention to the frame and springs and front axle. If welding is necessary it is done with an autogenous outfit, if riveting is essential pneumatic hammers are available, if compressed air is wanted for cleaning it is obtainable at



An Example of the Labor-Saving Equipment: Raising the Rear End of a Truck Chassis with a Portable Floor Crane.

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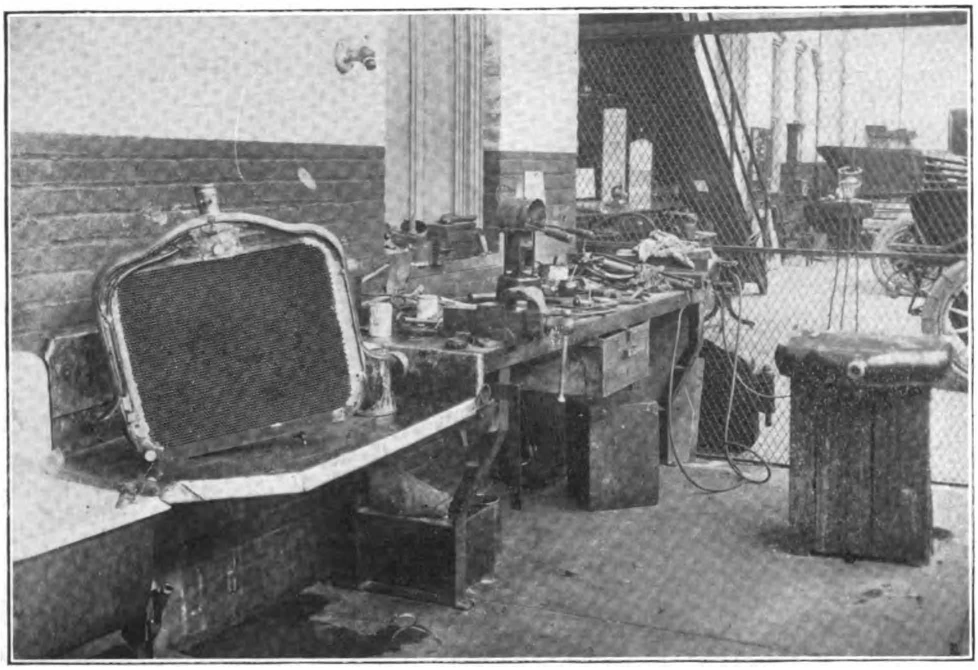
numerous leads. Usually there is abundant space and the men are not hampered by congestion and the light is practically as good as it is outside.

Extreme care is taken of stock and supplies. Nothing can be obtained from the stockroom without a requisition is presented signed by the foreman in charge of the work, and when this is issued a charge is made on the work order retained in the stock room office. This order indicates what work was authorized, and whether the part requisitioned is necessary is evident at a glance. Supplies of any kind are also charged to the men obtaining them and against the job, and in this manner exact record and responsibility is established, and if waste or loss is shown the men can be called to account. Large saving results in the aggregate from economies in oil, grease, waste and other necessities that can be wasted by thoughtless workmen.

When a foreman gives out work he hands a workman a time card carrying the job number and the task, which is stamped by a time clock. The workman continues with this until it is completed, or he is assigned to another job. If the former, he surrenders the ticket, which is stamped, showing the time he worked, the ticket being retained by the foreman until again issued for the completion of the work. If the latter, the surrendered ticket is stamped and is turned into the office. So long as the work is in progress the time cards are issued and sent to the office, and from these and the stock room record the bill is made out. Every minute of time and all stock or supplies can be accounted for. In the shop the work on the trucks and on the pleasure cars are directed by separate foremen. No public garaging is done at the station.



The Radiator Department, Where Repair, a Work Seldom Undertaken in a Service Station, Is Done by a Specially Trained Worker.

When a truck is sold the purchaser has the privilege of sending his driver to the service station for mechanical training, which he receives under the direction of the superintendent while working with the skilled workmen as helper, and he can continue this work, conforming, of course, to the regulations, until he is qualified to have instruction in driving. Or he is given instruction in this manner for a period stated by the owner. The man who has had no driving experience is taught what will be of most practical benefit to him. If a pleasure car driver, for instance, he is trained somewhat differently, according to the judgment of the superintendent.

When the driving lessons are given the man accompanies a thoroughly competent man, who trains him in the oiling, greasing, tank filling and other routine, explaining all conditions met with, and what attention is necessary in normal use. When the man is sufficiently experienced to be entrusted with a machine in the work that is to be done report is made to the owner, who can depend on this recommendation.

After a truck has been delivered by the company's branch or its agent a record of it is kept, and once a month or such a period as conditions warrant an inspector examines it, usually learning where it can be found on a specific date, and this examination is reported in detail on a blank that is filled by the inspector, covering the condition mechanically and all facts of importance that may be noted. These reports are sent to the superintendent of the service station, who then sends a form letter to the owner, informing him of all facts that should be brought to his attention, together with recommendations or suggestions as to attention, repair, driving, loading or other detail of care and maintenance. Copies of the letters are kept in the file of truck records.

This supervision is continued each month, as above, and when necessary overhaul is advised. The company will make estimate of the probable cost for the information of the owner, will undertake the work for the cost of labor and parts used will permit the owner to place the truck in the station where his driver can do the work with assistance or under the direction of the foreman or superintendent, or will send expert workmen to the owner's garage to work with the driver and direct and advise him. If the owner desires the work done by a garage or repair shop the company is equally consistent and will advise or assist him in any way.

From the time the truck is sold the company, without expense to the owner, supervises its use, makes recommendations and suggestions that will benefit

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him materially, and when work is done gives him the benefit of expert knowledge and a carefully developed organization and facilities that are equal to those of the factory. This is gratis, a work that the company has undertaken for the benefit of its customers, and is continued wherever White trucks are in use. As White machines are in service all over the North American continent the magnitude of this supervision is apparent. And it is constantly increasing.

POPE WEST WORKS BOUGHT.

The West Works of the Pope Manufacturing Company, Hartford, Conn., which was the last remaining property of that concern in Hartford, and all that remained under the jurisdiction of Col. George Pope, receiver for the company in Connecticut, has been bought by P. Garvan, Inc., a paper dealer of that city, for $80,000, or about 73 per cent. of the appraised value. The property will be converted to paper manufacturing. The plant at Westfield, Mass., where bicycles, motorcycles, etc., are built, will be sold as a going concern.

WANT ADAMSON BILL ENACTED.

The Adamson bill, sponsored by Congressman Adamson of Georgia, chairman of the committee on interstate and foreign commerce, now pending in the House of Representatives at Washington, which has the support of practically all the motoring organizations and the American Automobile Association, provides that the owner of a motor vehicle who has complied with the registration law of the state in which he resides shall not be compelled to take out additional registration or license to operate such vehicle in any other state, territory or district of the nation.

The decision of the United States supreme court, through Justice McReynolds, that in the absence of national law a state can enact such laws as may appear necessary with reference to motor vehicles, pending which decision the Adamson bill had been held, is the reason for the endeavor to secure the passage of the measure. In the opinion of Justice Day of the United States supreme court the decision has invalidated the motor vehicle statutes of California, Colorado, Connecticut, Indiana, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Oklahoma, Oregon, Pennsylvania, Wisconsin and Porto Rico.

TAX THE MOTORISTS, SAYS CARLISLE.

Commissioner of Highways John N. Carlisle of New York state, who has estimated that his department will require $4,000,000 for road maintenance in 1915, and which will have but $1,530,000 available, suggests that the remaining $2,470,000 be provided by taxing motorists. He does not want the owners of machines to pay it all for registration, but has suggested in a recommendation to the legislature that motor omnibuses be taxed on a basis of miles driven because they are in competition with railroads and trolleys, and that cars from other states be required to contribute by a tax imposed on each gallon of gasoline or other fuel purchased while in New York. As the motor omnibuses are operated principally in the cities and do not use the state roads to any material degree, and the cars from other states are not required to pay a registration fee largely from the fact that this privilege is a matter of reciprocity with other states, the justice of the proposition is apparent. The fact that many trucks are owned in other states and are used in what is literally interstate commerce with New York appears to have been overlooked. From one point of view, at least, the proposal would be a state tax on interstate transportation.

HOWARD TO SELL GMC TRUCKS ABROAD.

The General Motors Truck Company, Pontiac, Mich., has sent S. B. Howard from Pontiac to London, England, where he will serve as special representative, directing the sales of both gasoline and electric machines aside from orders for war purposes. When he sailed Mr. Howard expected to be absent for at least six months, but his sojourn will depend largely on the continuance of the war.

A Jeffery Quad Driving a Path Through Snow a Week Old and 12 Inches Depth, a Test That Shows the Tractive Power of the Machine.

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BIG TRUCKS LONG ENDURE.

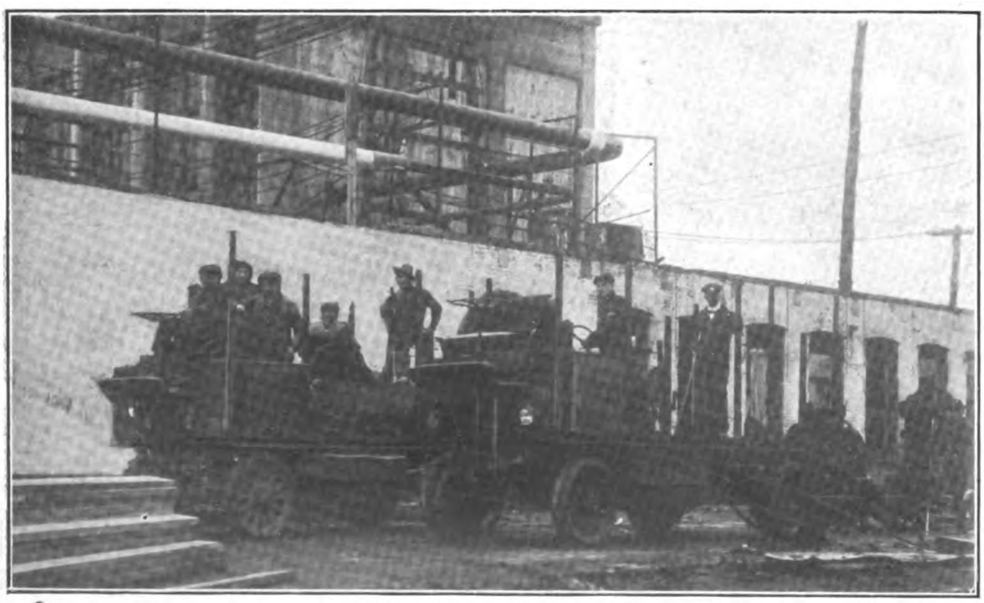
Ten-Year-Old Machines Hard Worked in Rebuilding Burned Edison Plant.

The really surprising result of the destruction of a number of the buildings of the Edison plant at Orange, N. J., was the energy manifested in the reconstruction of the buildings, this work being carried on with a very large force of workers and with unusually complete facilities. The burning of the woodwork of many of the structures necessitated the removal of debris before the rebuilding could be begun, and this entailed the cartage of thousands of tons of metal and other ruins and the thorough cleaning of the big concrete shells. Handling the heavy iron and steel work required derricks and vehicles of large capacity.

"Doing is electrically" is to be expected of Mr. Edison, and as soon as the needs were evident two of the five-ton electric trucks of the New York Edison Company were driven to the works, where they have since been worked each day. That the company, which always has transportation needs that equal the normal capacity of its equipment, turned over its machines for the service of another is somewhat unusual, but the statement may be made that its officials desired in every way to assist Mr. Edison, and the two trucks, which have electric windlasses and are used for cable laying and hoisting, and could be extremely useful in the rebuilding operations, were placed at his disposal. These machines have hauled thousands of tons of material during the time they have been worked.

The really interesting fact from a transportation viewpoint is that these trucks, selected because of their efficiency and capacity, have been used by the New York Edison Company for a dozen years and are seemingly equal to any requirement. They were built by the Vehicle Equipment Company and originally had plain bronze axle bearings, but a year ago these were replaced by roller bearings and the batteries were reduced from 48 to 44 cells, this showing really a gain of nearly 10 per cent. in mechanical efficiency and being a very good demonstration of the improvement made in machines.

In 1904 these trucks hauled the largest block of stone ever brought into New York, save Cleopatra's Needle, which was transported from pier 4, at the foot of Broad street to the site of the Custom House. The stone was quarried and dressed at Hurricane Island, Penobscot Bay, Me., three years being required for this work, and the stone when ready for shipment was valued at $10,000. It was brought by vessel to New York and from the bulkhead between piers 3 and 4 was hauled on a special truck.



Two of the Five-Ton Electric Trucks Owned by the New York Edison Company, 12 Years Old, Used in the Reconstruction of the Edison Works at Orange, N. J.

WHEEL TAX BILL IN NEW JERSEY.

A bill approved by the Associated Automobile Clubs of New Jersey, to be presented in the New Jersey legislature, comprehends a wheel tax on all animal drawn vehicles or apparatus drawn on the public highways, save agricultural implements, of $1 a year for vehicles with capacity of 1000 pounds or less, $2 a year for vehicles with capacity of more than 1000 pounds to 8000 pounds, and $4 a year for vehicles having capacity in excess of 8000 pounds. The bill provides that 75 per cent. of the tax shall be returned to the county from which it is received, to be expended on the roads of such county, and the remainder shall be added to the general state highway fund.

STONE DISCUSSES BODY DESIGN.

F. M. Williams, who was to lecture on highway improvement to the members of the Motor Truck Club of America at the January meeting of the organization at the Automobile Club of America, New York City, was unable to be present and Charles E. Stone, formerly general manager of the club, gave an illustrated talk on body designs, paying particular attention to types desirable for special conditions. The lantern slides showed numerous bodies that have proven economical where ordinary construction would not serve any useful purpose.

During the evening President Pratt presented former president George H. Duck a sterling silver coffee set in behalf of members of the club as a recognition of his services while its executive.

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TESTS OF DUPLEX FOUR-WHEEL DRIVE TRUCKS.

Machines of Moderate Power That Have Remarkable Traction in All Operating Conditions, Lower Fuel Consumption and Extreme Endurance.

POWER rating obtained from the S. A. E. or other formula is frequently accepted as sufficient on which to base estimate of efficiency, but the rating does not establish what proportions of the power developed is delivered at the driving or traction wheels, and neither does it demonstrate the volume of fuel necessary to do a given work. A vehicle power plant ought to be as small as is consistent with the energy that must be produced, and the smaller the loss from frictional causes the greater the proportion that can be exerted at the wheels. If the motor, clutch and the transmission system are so constructed that practically all the power is realized, the fuel consumption will be relatively small. This, then, demands an engine that will consume comparatively little gasoline, and driving mechanism that will transmit the energy with high efficiency.

Tractive effort at the rear or front wheels of a power wagon is variable, because the surface of the roadway may differ, and traction may not be equal. In such an event there is no diminution of fuel consumption. This has led to the use of four-wheel traction, resulting in changed design to distribute the weight of the vehicle and load equally on all four wheels, the driving effort being in like ratio to the distribution of the weight.

The Duplex-Power Car Company, Charlotte, Mich., was originally organized to build a four-wheel driven motor truck, it being stated that this concern was a pioneer in this construction, and for six years it has specialized this particular type, in which the axle jackshafts driving spur pinions mesh with internal ring gears enclosed in drums on the rear wheels. The fundamental principles that prompted the building of the first truck was primarily to have as small a power plant as was practical because of the need of fuel economy, next to have a transmission system that would have as high a ratio of efficiency as could be obtained from the fuel used, and beyond this to minimize the expense of tires by equal wear upon all four.

In experiments, on level surfaces, tractive effort ought to be equal, whether by two or four wheels, but when traction is lessened by wet paving, mud, snow, sand or loose soil, with but one or two wheels driving, half the useful power available is lost. With four wheels driving the loss of power can be greatly reduced, because with four points of contact with the highway there is less probability of reduction of traction. In experimental work and service the utility of the Duplex drive was found to be so superior to any other system that tests of extreme character were made in conditions where the practical use of motor vehicles would seemingly be impossible.

The Duplex trucks are built in two sizes, model C of 4000 pounds capacity and model D of 6000 pounds capacity, both practically alike aside from the increased proportions of the latter, and these represent the development of six years' experience. These two machines conform to the specifications of the United States War Department, which comprehend military service vastly more severe than would be entailed by average highway haulage, and are constructed of the best material obtainable. In considering these requirements the fact that the load is carried on dead axles, that the jackshafts merely transmit the power, that the wheels are interchangeable, that the transmission system by its reduction has more available power, that the driving system is fully protected and is fully lubricated, that all bearings are unusually large, and that there is at least a 100 per cent. overload factor of safety, are all of material importance.

Duplex Four-Wheel Drive Truck During Test of 100 Miles in Deep Snow for United States War Department Inspector.

The Duplex trucks are extremely light, because of the quality of the material of which they are constructed, and the fact that the freights carried are equally distributed, and there is corresponding reduction of wear because the parts are

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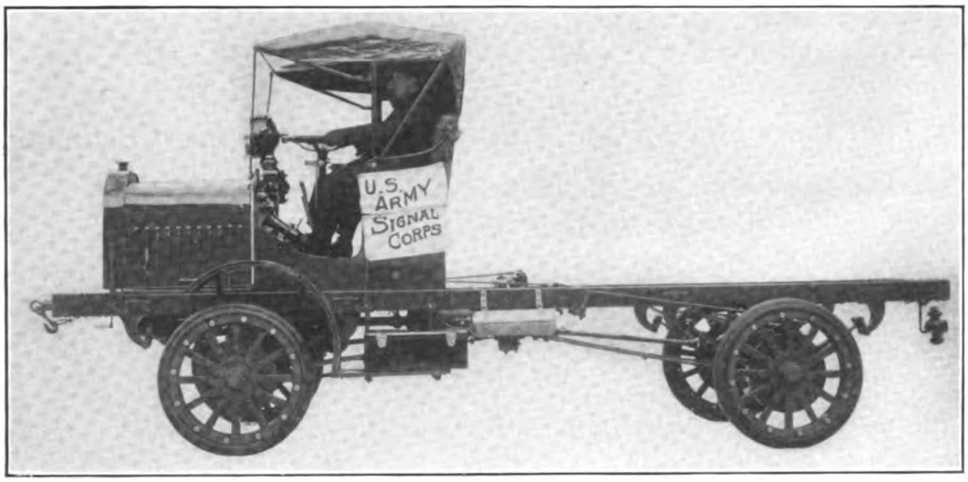

Chassis of Two-Ton Duplex Truck of the Type Purchased by the Government for the Use of the Signal Corps.

not subjected to the severe stresses that are borne by the two-wheel driven machines. This lightness is a reason for lessened fuel consumption, for power must be developed to propel any truck. The efficiency of the internal drive has been tested for years abroad and has been found to be extremely high; so high, in fact, that no one who ever utilized it has ever had occasion to change. Not only this, the system will endure for an indefinite period, because of the minimum wear.

The United States War Department has Duplex trucks in its service, which were purchased after a test that was probably more severe than was ever made with any machine it has ever bought. These are used by the Signal Corps. The War Department sent Major F. E. Lacey as its inspector from Chicago to Charlotte to examine and test the trucks if they were of a character of construction to meet with the requirements of the service. The trial was made without preparation, two machines being selected from stock and each was loaded with 5000 pounds of stone. With the tanks filled, each carried 25 gallons of gasoline in its main tank, five gallons of reserve gasoline and three gallons of reserve oil.

The run was to be 100 miles, to Eaton Rapids and return, and speed to be as fast as could be made. The weather conditions were unusually severe, a very heavy fall of snow having been followed by rain. Snow was drifted three and four feet deep in places, had been saturated by water, and the roads had not been broken. The road traversed was alternately ice and snow drifts, and with the cessation of the rain the temperature fell so that there was a crust formed that would bear a man's weight.

Each machine carried three men. Twice going out the leading truck slipped from the road, once going down an embankment and sinking into snow more than two feet deep, and the second time going into a ditch, where the track was 36 inches below the level of the snow. The delays were the only untoward results. The outward trip was the real trial because of the unbroken road, but returning the speed was increased considerably in the track broken going out. The power of the trucks was more than ample and the oil reserve was not touched, despite much driving on the lower speed ratios. The test was so satisfactory that Major Lacey's report was practically an order, and shortly after the machines were delivered to the War Department at Chicago and San Francisco, Cal. These machines are operated in work and conditions that are intended to prove them in every way mechanically, and long endurance is quite as essential as is capacity in army service.

Other tests made by the company have demonstrated the power efficiency quite as much as did that just specified. In one instance the company's chief tester drove a truck up the front steps of the court house at Charlotte. In another a trial was made with three farm wagons as trailers. In this the truck was sent to H. H. Bryan's farm, five miles distant from the city, and there taken three-quarters of a mile into the farm, across fields and ploughed ground, loaded to capacity with beets, and driven to the main highway. There it was coupled to three farm wagons, each loaded with beets, and the train hauled to Charlotte. The total weight of the loads was 14 tons and the truck and wagons weighed about six tons, so that a total weight of 20 tons was hauled. These particular trucks used in these tests were purchased for the use of the Signal Corps.

Testing a Duplex Truck with a Freight of Pianos in Snow Nearly Up to Chassis Frame.

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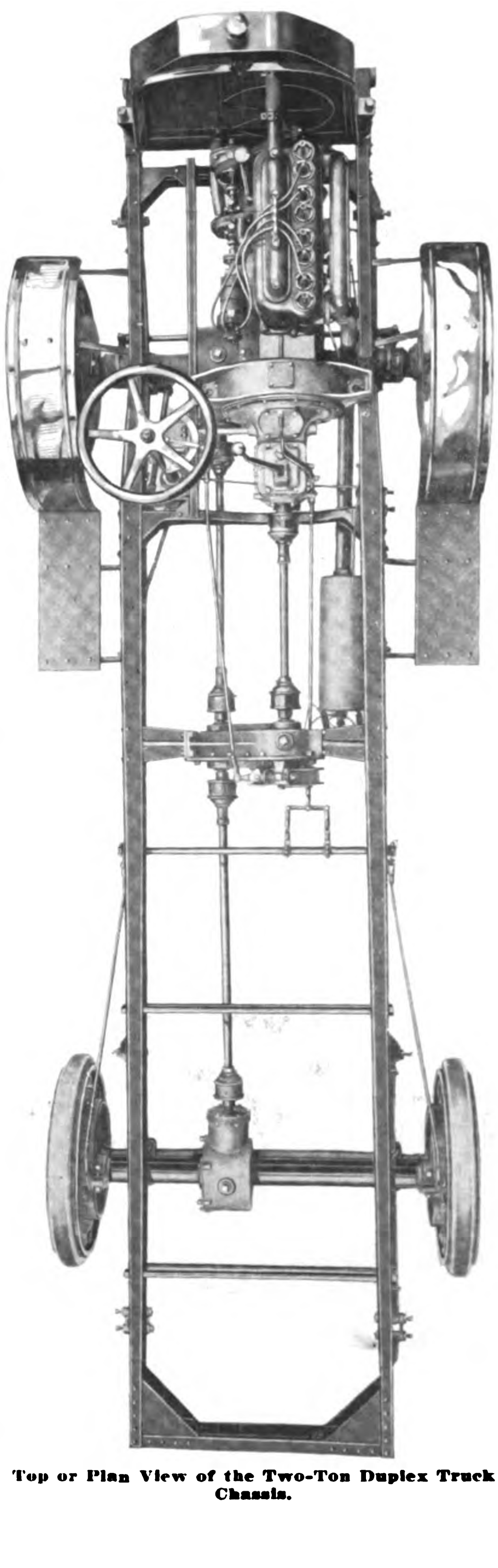
MECHANICAL FEATURES OF DUPLEX TRUCKS.

EXTREME efficiency at low operating cost is the purpose of the design of the Duplex trucks, built by the Duplex-Power Car Company, Charlotte, Mich., which are known as model C, with load capacity of 4000 pounds, and model D, with load capacity of 6000 pounds. The chief characteristic of the machines is that they are driven by all four wheels, and steered by either two or four wheels, according to the uses to be made by the owners.

The Duplex-Power Car Company claims to be the builder of the best vehicle of this type in the world, and a number of patents are owned by it which protect different features of the design. The machines have been perfected and refined as experience has developed possibilities and necessities, and statement is made that the types that will be produced this present year are decidedly the most efficient and satisfactory ever constructed, despite the fact that those built previously demonstrated marked qualities in comparison with vehicles driven by two wheels.

The Duplex Power Car Company has seemingly progressed slowly because of the necessity of proving the qualities claimed for its trucks, and the assumed belief of many that the two-wheel driven machine was sufficient in ordinary conditions of operation. The possibilities of the design were not generally understood, but with the better realization of the needs of minimizing fuel consumption and tire wear, two extremely important factors in motor truck operation, the economy of the four-wheel drive has been thoroughly established.

The Duplex trucks are propelled by motors of conventional type with shafts extending from the main shafts of the gearsets to what may be best described as junction boxes or sub-transmissions. In these junction boxes are main and countershafts. Power is transmitted from the main shaft to the countershaft of the junction boxes by silent chains. To the ends of these countershafts are coupled the longitudinal driving shafts, which carry pinions that mesh with bevel master gears that are assembled with conventional differential gearsets in jackshafts mounted on the forward and rear axles, and pinions on the ends of the jackshafts engage with internal ring gears on the wheels. This briefly explains the driving system. In this design on a level surface each wheel ought to have the same tractive effect, provided each wheel carries the same weight, and the chassis are built with the purpose of equalizing the weight when the vehicles are loaded. That is, with the two-wheel driven wagons and trucks the rear axle carries from 60 to 90 per cent. of the load, but each axle of a Duplex machine carries approximately 50 per cent. With the load judiciously placed on the Duplex trucks there will be very little variance from the proportions stated.


Top or Plan View of the Two-Ton Duplex Truck Chassis.

Turning to the mechanical detail of the Duplex chassis: The designs are identical, the proportions of the 6000-pound truck components being somewhat larger than those of the 4000-pound type. Perhaps this will be best demonstrated by specifying the motors, the smaller having bore of 4⅛ inches and stroke of 5½ inches, and the larger a bore of 4¼ inches and stroke of 5½ inches, the former having a horsepower rating of 27¼ and the latter a rating of 28.90 by the S. A. E. formula.

These motors are a vertical water cooled, four-cycle, L head type, with the cylinders cast en bloc with the water jackets integral from a special grade of gray iron. The water jackets are designed so that the water is discharged into them from the pump directly beneath the valves. The jackets are covered with a large plate that is

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Duplex Stripped Two-Ton Chassis, This Being the Size Adopted for the United States Army Service.

pounds to the square inch, and the elastic limit is 85,000 pounds to the square inch. The shaft is mounted in three main bearings of nickel babbitt, the forward bearing being 1⅞ inches diameter and 3⅛ inches length, the centre bearing two inches diameter and 2½ inches length, and the rear bearing 2⅛ inches diameter and four inches length. The crankpins are 1⅞ inches diameter and 2⅛ inches diameter and four end bearings of the connecting rods are nickel babbitt, and the

channelled to direct the flow of the water toward the outlet manifold, the plate being retained by cap screws. The castings are made with much care, being first tested for leakage by water pressure and are bored, aged and ground and again tested by water pressure.

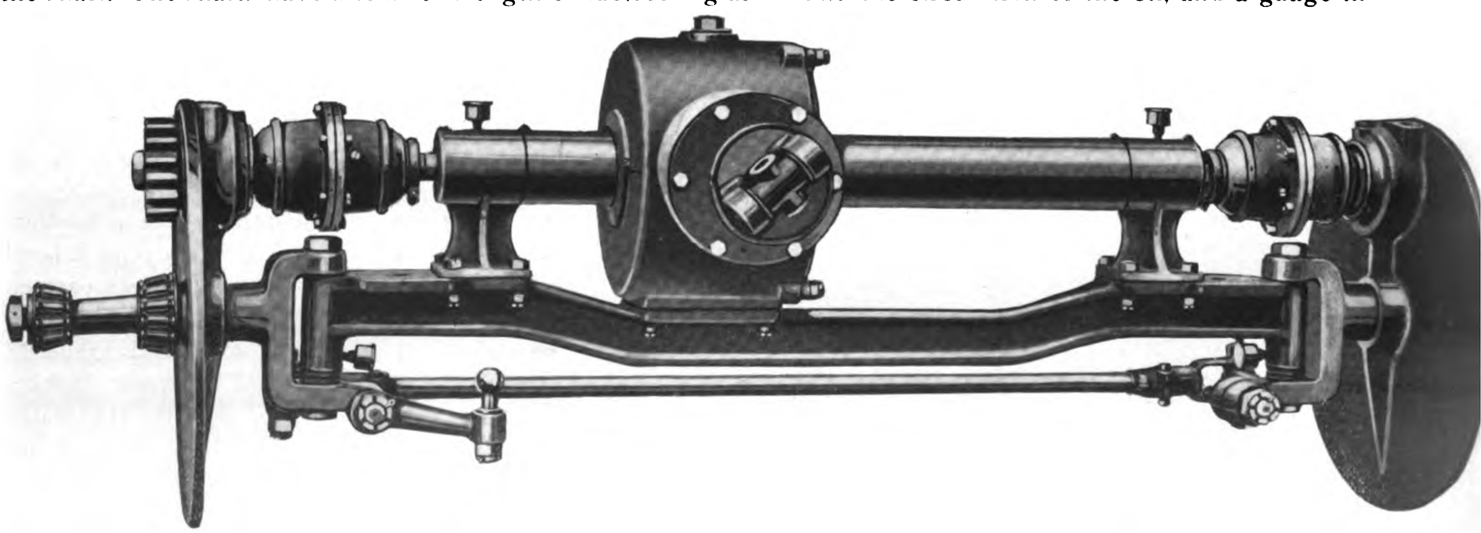
The crankcase is an aluminum alloy casting, composed of two sections, the upper half carrying the main and camshaft bearings and the lower section serving as an oil reservoir, there being a horizontal transverse web that contains the troughs of the splash lubrication system. The centre main bearing is supported by a vertical transverse web. The pistons are cast of a superior quality of iron and are carefully turned and ground to size. They are fitted with four eccentric piston rings that are made of open-hearth steel, case hardened and ground and polished, these being above the wristpin. Three grooves in the skirt of the piston insure the distribution of the lubricant.

The connecting rods are open-hearth steel drop forgings that are heat treated, and the wristpins are of the same material, case hardened and accurately ground and fitted. The crankshaft is a special steel drop forging, machined and heat treated and ground to size. The flywheel flange is forged integral with the shaft. The shafts have a tensile strength of 120,000

wristpin bearings are phosphor bronze. The wristpins oscillate in the piston bosses. The crankpin bearings are retained by nickel steel bolts and caps.

The camshaft is a steep drop forging with the cams integral, case hardened and accurately ground, the timing gear being bolted to a flange. The timing gears, four in number, are helical cut, flanges being provided to take care of end play. These are enclosed and are noiseless in operation. The valve ports are 1⅞ inches diameter, and the valves have nickel steel heads and soft steel stems, electrically welded. The valves are fitted in long guides. The valve tappets of a mushroom type operate in guides and have the usual adjusting screws and nuts.

The motor is cooled by a circulation of water through the engine and a large radiator, it being forced by a bronze centrifugal pump, and radiation is furthered by a fan of special design that is mounted on two sets of ball bearings. The motor is lubricated by a combination force feed and splash system, the oil being drawn from the reservoir by a plunger pump, forced through tubing to main bearings and the timing gear case, the overflow filling the troughs below the big ends of the connecting rods. Deflectors prevent the escape of oil through the bearings. A sight glass shows the circulation of the oil, and a gauge in-



The Axle, Jackshaft and Differential Used for the Front Wheels of Two-Wheel Steer, and for Both Axles of Four-Wheel Steer, Duplex Four Wheel Drive Trucks.

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dicates the level in the reservoir. The pump and strainer can be removed from the outside of the crank case. The intake and exhaust manifolds are of proportions to insure full charges of fuel and complete exhausting of the cylinders. The carburetor is an automatic float feed type. The engine is governed by a Duplex centrifugal governor. The ignition is by either a Bosch or an Eisemann magneto, this being optional with the purchaser.

The clutch is a multiple disc type, oil lubricated, and the gearset is a selective sliding gear construction that has four forward speed ratios and reverse. The motor, clutch and gearset are assembled as a unit power plant that is mounted on three points in the frame. The radiator, a vertical tube design, is carried on spring supports to protect it against strains from chassis distortion.

The driving shaft is coupled to the main shaft of the gearset and the main shaft of the junxtion box of two universal joints, and the junction box gearset is mounted on a very heavy frame cross member amidships of the chassis frame. The rear end of the main shaft of the junction box carries the drum of the service brake. The main and countershafts of the junction box are fitted with sprockets 3½ inches width that are coupled by a silent chain which affords a two to one reduction at the countershaft. This junction box is designed to provide a bath of oil for the chain. From either end of the junction box countershaft the driving shafts, with a universal joint at either end, extend to the differential gears of the axle jackshafts. The simplicity of this construction may be noted by reference to the top view of the chassis, and in effect it is merely parallel shafting with a reduction at the centre of the second shaft.

The axle jackshafts are of two types, that illustrated being what is used for all forward axles, and for both axles of the four-wheel steer machines. The axle is a drop forged I section with a pivot boss at either end, with the seats for the jackshaft brackets integral. The axle stubs or spindles are formed with heavy yokes that carry vertically webbed spiders or flanges, outside of which the Timken roller bearings are fitted. The yokes are mounted on the axle by large pivots. The jackshaft consists of a differential case with a cover plate at the side, with a tubular housing that is fitted at either end into the heavy jackshaft bracket. The jackshaft is mounted in heavy roller bearings. Outside of the brackets, through which the driving shafts project, are universal joints that are enclosed in dust tight housings, these housings being secured to the spiders or flanges. These joints are packed in grease. The shaft stubs extend through the spiders and on them are mounted spur pinions. The flanges also support the shafts for the external contracting band brake shoes. The centres of the jackshaft universal joints are directly above the axle pivots, so that there is a perfect balance of the steering gear and the control is easy at all times. The axle spindles or stubs are operated by the conventional linkage when steered by two wheels, or by linkage that actuates all four wheels when this construction is preferred.

The Interchangeable Type of Wheel with Internal Gear Used on All Duplex Trucks.

With the two-wheel steer the rear axle is an I section of drop forged steel with the axle spindles integral, and carries the flanges or spiders that support the jackshaft housing ends and the brake shafts. In

Duplex Two-Ton Truck Hauling a Train of Three Lumber Wagons, the Combined Loads Weighing 14 Tons and Vehicles Six Tons, a Total of 20 Tons.

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the housing the differential and the shafts are mounted on New Departure annular ball bearings. The ends of the driving shafts are fitted with spur pinions. The axle spindles are equipped with Timken roller bearings.

With either type of construction the driving thrust and braking stress is taken by long radius rods, these extending from the front axle and from the rear axle to heavy brackets mounted at the centres of the side members of the chassis frame. With a load the driving shafts from the junction box to the axles are very nearly if not quite parallel to the frame The frame is a heat treated five-inch steel channel, with five cross members and two tie rods, strongly gussetted, that is suspended on very heavy steel hangers and semi-elliptic springs shackled at either end. These springs are mounted on the steering axles under the universal joints, and on the dead axles under the jackshaft housings. Being free to support the loads, each carrying 25 per cent. of the weight, the springs are especially resilient and efficient.

The wheels are wood or steel artillery type, and are fitted with 36 by four-inch demountable tires for the two-ton machine and 36 by five-inch tires for the three-ton truck. On these wheels are mounted 18-inch diameter steel drums, each having an internal ring gear cut in the inner periphery, which meshes with the spur pinion on the ends of the jackshafts, this being an internal drive on each wheel. The standard wheelbase is 130 inches, with a chassis frame length of 218 inches, the power plant overhanging the forward axle and insuring the even distribution of weight. The steering gear is a worm and gear irreversible type, with the steering column at the left side. The clutch and the service brake are operated by foot pedals, the gears are shifted and the emergency brake is applied by central hand levers, and the ignition spark and the fuel throttle are controlled by hand, the latter being under the wheel on the steering column.

The service brake, operating on an extension of the main shaft of the junction box or sub-transmission, is eight inches diameter and two inches face, with which the machine can be stopped in its own length. The emergency brake shoes are on the steel driving drums, which are 18⅜ inches diameter and 2½ inches face. The design has very careful provision for lubrication, there being oilers and grease cups on every wearing part. The intention of the designer has been to retain the lubricant and exclude the dust, minimizing wear. Claim is made that these chassis are the simplest in construction, having less parts than any machines of similar capactiy that are built.

Estimates made indicate that the crude rubber production for 1914 was 107,000 tons, or about what was produced in 1913, of which about 65,000 tons was plantation rubber. While the plantation rubber output increased from about 46,000 tons in 1913, the crop of Para rubber was considerably decreased.

NUMBER OF TRUCKS IN THE WAR.

The armies of Germany, France and England have in use more than 150,000 automobiles of every kind, according to Vorwaets, Berlin, Germany Two days before the declaration of war, says this authority, the French government issued a prohibition against the exportation of automobiles, from which may be gathered the number of such vehicles at the disposal of the French military authorities upon the outbreak of the war. The military automobiles of every kind, including those for the transportation of guns, ammunition and aircraft, numbered about 18,000. The number of private cars available for requisition was 50,000, while the city of Paris was expected to provide 1100 motor omnibuses. Altogether the French army had available more than 70,000 vehicles.

The number of German automobiles at the front has been estimated at somewhat less than 55,000. Of these 30,000 are actually military vehicles, while the number of private cars requisitioned is said to be only half as great as in France, or about 25,000. The English have dispatched about 20,000 automobiles of every kind to the front, 1000 of which are London 'buses.

RAFFLE HORSE TO BUY TRUCK.

Protector Fire Company, No. 2, Thibodaux, La., has resorted to unusual means to raise money to pay for the motor apparatus it has ordered for the protection of the property of the town. To replace its horse equipment the company mortgaged its property, and then with the belief that the townspeople ought to share the expense so far as possible, the animal that had served it for several years is to be raffled, the proceeds to be devoted toward paying a part of the mortgage. The firemen believe that if the people are loyal they ought to realize a considerable part of the purchase price of the machine and at the same time somebody will obtain a horse that will be a worker every time there is a fire alarm.

MAY REPLACE 266 HORSE TEAMS.

The city of Milwaukee, Wis., plans to replace by motor trucks the 266 teams now used for the collection of ashes and garbage. John Davis, director of the bureau of municipal research, has completed a report of his investigation of the plan of substituting motor trucks for horse teams and this is said to be favorable to the change.

WANTS POLICE AUTOMOBILES.

Richmond, Va., will shortly annex a great deal of outlying territory, and Chief of Police Werner has requested the police board to buy 10 runabouts, claiming that with the machines the location and maintenance of police stations in the section to be annexed will not be necessary.

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TWO NEW MACK WORM DRIVEN TRUCKS.

FOLLOWING a policy of development and meeting a demand that has been stimulated by general economic needs of business men, the International Motor Company, New York, N. Y., has produced two new types of Mack trucks, these being 2000 and 4000 pounds capacities. These vehicles have been very carefully designed, and have numerous features, these including specially designed motors and worm and gear drive. Some of the Mack characteristics are evidenced in the machines, but they can be accepted as entirely new constructions.

The worm and gear drive is the conventional type adopted by American motor vehicle builders, having the full-floating rear axle, and the designer has adopted foreign practise in that the drive is through the rear springs, these being pivoted at the forward ends to brackets mounted on the frame of the chassis, doing away with radius rods and torque arms. The power plant is a unit in which the engine, clutch and gearset are combined, and the designer has sought to make the motor unusually accessible, so that the usual work in connection with adjustment, care or repair can be accomplished with a minimum of labor. There are numerous features of construction in which the engineer has varied from accepted practise and worked out details that make for what experience has demonstrated are desirable, especially with reference to lubrication and temporary restoration to serviceability in the event of accident.

The description that follows will apply to the 4000-pound machine. The power plants in this and the 2000-pound vehicle are the same, but in proportions those of the small truck differ slightly from those of the larger.

Motor Cylinders Cast in Pairs.

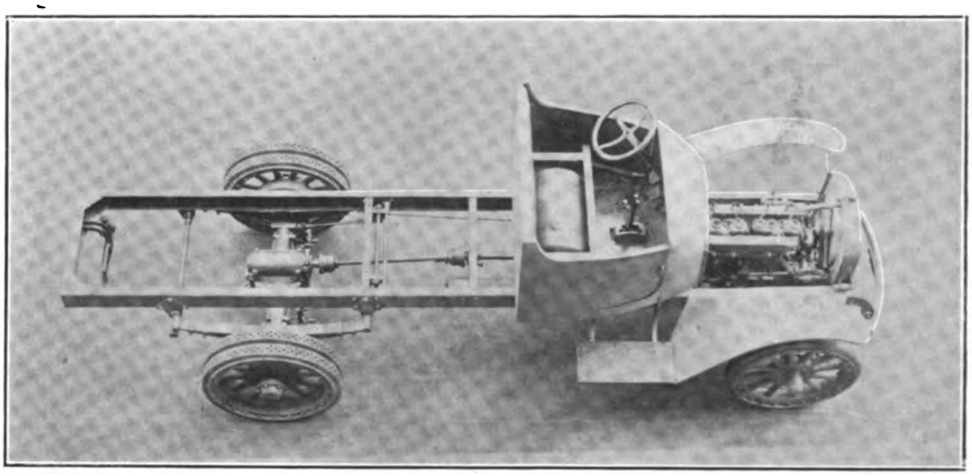
The motor is a four-cylinder, vertical, four-cycle, L head type, with the valves at the right side. The cylinder bore is four inches and the stroke five inches, this being rated at 26.6 horsepower by the S. A. E. formula. The statement is made that the engine will develop an average of 30 horsepower during a continuous 10-hour test.

The cylinders are cast in pairs, the units being a special gray iron, and much care is taken to insure large water passages and consequent efficient cooling. The castings are first water tested and then bored, following which they are annealed to reduce all deformities from casting strains. They are then rebored, reamed and ground, the statement being made that when thus finished there is certainty that the cylinders will not distort and will retain high compression as long as used.

The pistons are cast of a special formula iron and are very long and light, and are carefully finished. They are balanced separately and are again balanced with the connecting rod, this insuring a well operating motor. The rings are finished by peining on the inside, this process setting up a strain them that insures equal pressure around the cylinder, and as the rings are very carefully fitted to the grooves the desired degree of compression is secured and retained in service.

Crank Case in Two Sections.

The crank case is an aluminum alloy casting made with upper and lower sections, the lower forming the oil reservoir, and rear extensions form the housings for the flywheel, clutch and gearset. The upper portion of the case is strongly webbed and carries the main and the camshaft bearings. These bearings are not disturbed when the lower section is removed. The main bearings are capped, and these caps are retained by through bolts. The rear set of through bolts supports the motor from a cross member directly behind the rear cylinder, and a large stud in the cast steel housing of the timing gears, which is fitted in a socket in a cast steel frame cross member that is directly beneath the radiator, supports the forward end of the engine. The motor is suspended from one point at the front end and by two points by the rear cross arms.



Chassis of the Two-Ton Worm Driven Mack Truck, Showing the Cowl Dash and the Enclosed Driver's Seat.

The designing of the crank case is such as to afford unusual accessibility to the engine and to minimize work upon it necessary for repair or maintenance. At one side are two large covers that can be removed by taking off two winged nuts and access had to the main, camshaft and connecting rod big end bearings. By removing the lower section of the crank case any one of the connecting rods can be disconnected from the crankpin, and there is sufficient clearance so that the piston may be dropped and taken out of the cylinder. This provision has been made so that in the event of

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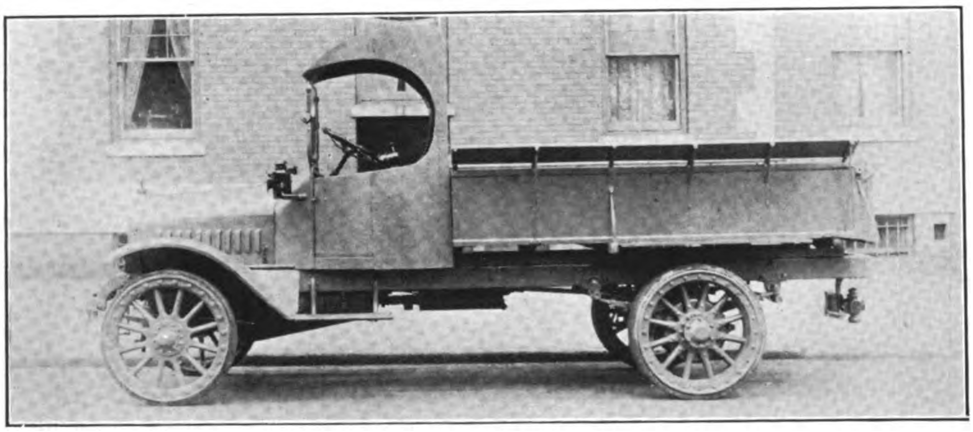
need a piston and connecting rod may be taken out without removing the cylinder unit from the crank case, the large inspection openings and the removable lower section affording ample space and good light, so that work can be quickly done. The statement is made that a piston can be removed and the base of the engine case and the inspection plates replaced in approximately 40 minutes. Should a connecting rod bearing be burned while on the road, or some other accident happen that would entail removal of a piston, further damage could be averted by immediate work and the engine operated with three cylinders, for instance.

Crankshaft Is Very Heavy.

The crankshaft is a special alloy steel drop forging that is carefully machined, hardened and ground to size, having unusually heavy webs, and being of proportions sufficiently large for a motor of 60 horsepower. The main bearings are three inches diameter and the crankpins are 2¼ inches diameter, insuring against wear or springing, and, of course, greater endurance for the main bearings. The camshaft is a steel drop forging with the cams and the worm by which the oil pump is driven integral. The shaft is carried in three bearings that are larger than the cams, so that the shaft may be withdrawn from the forward end of the crank case, after the cover of the timing gears has been removed, through the bearings without disturbing them. The cams have half-inch faces and are hardened to afford long endurance.



Two-Ton Mack Worm Driven Chassis Equipped with Flareboard Express Body and Driver's Protected Cab.

The connecting rods are exceptionally long, from centre to centre of the crankpin and the wristpin being 12½ inches, this length giving the clearance for removing the pistons as stated and minimizing side pressure of the pistons on the cylinder walls. The connecting rods are drop forged, of light section, and care is taken in balancing the motor to have all rods in any one engine of the same weight. The wristpins are hardened steel and are clamped into the ends of the connecting rods by locking bolts. The pins oscillate in large bosses in the pistons, the bearing surfaces being of unusual proportions.

The motor has three timing gears of bevel type, one on the crankshaft, one on the camshaft, and a third that drives both the water pump and the magneto through a spiral gear on a cross shaft ahead of the forward cylinder. These gears are cut at a 45-degree angle and are practically noiseless, while they can be very readily removed. The cross shaft is centred in the housing of the gears and the driving shafts of the water pump and the magneto are coupled by leather universals that compensate for any variation in alignment. The water pump is at the right side and the magneto at the left side of the motor. The valve mechanism is conventional in type, the valves being completely enclosed and protected against abrasion.

The Cooling System.

The motor is cooled by a circulation of water through the large water spaces of the cylinders and a radiator of the honeycomb type. The water outlets on top of the cylinder units are castings of ample proportions, designed to draw an equal volume of water from each cylinder. The water inlet manifold is cast in combination with the intake manifold of the carburetor and is fitted against the two cylinder units, this design minimizing the piping and water jacketing the intake so as to maintain a higher temperature and better volatizing the fuel as it passes from the carburetor to the cylinders. The water pump is a centrifugal type constructed of steel, bronze and cast iron. The impeller is balanced so that there is equal flow of water directed upon it and the wear is equalized. Radiation is insured by a large fan driven by a flat belt from a pulley on an extension of the camshaft. The fan is mounted on roller bearings and is adjustable by an eccentric.

The lubricating system of the motor is a combination of the force feed and constant level splash systems. The lubrication of the connecting rods, wristpins, pistons and cylinder walls, cams and tappets is by splash, but the three main bearings and the timing gears are flooded with oil under pressure. The lower section of the crank case contains the main oil reservoir and a pump that is driven by a spiral gear on the camshaft. The oil is drawn from the reservoir through a strainer and forced through a tube to an auxiliary reservoir mounted on the left side of the forward cylinder. The pump is a unit that can be removed with the bottom half of the crank case and is easily accessible through the inspection openings in the case. From the auxiliary reservoir the oil is forced through a filter and tube to the timing gears and the three main bearings, overflowing from these to the base of the crank chamber, where it collects in the troughs under the crank throws and is distributed by the sweep of the big ends of the connecting rods. The oil is constantly circulated, is perfectly filtered, and the contents of the auxiliary reservoir are heated sufficiently to have good

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viscosity when the motor is in operation. The ducts for the circulation of the oil are cast integral with the crank case sections and cylinders, this affording a construction that is especially enduring and satisfactory.

The exhaust manifold is large and is "twinned" so that there is no possibility of back pressure. The carburetor is an automatic float feed type that is stated to afford satisfactory mixtures in all conditions of operation, and to be in every way efficient and economical of fuel. The ignition is by a Bosch high-tension magneto, with short cable leads, and these are well protected in a fiber tube. The magneto is driven with a leather universal joint and it is located so that it is unusually accessible and convenient for examination or work. The engine is governed by a centrifugal type of governor, which consists of two weights mounted inside the camshaft timing gear. As the speed of the motor is increased these weights are thrown out, and they in turn press forward a cone shaped member that moves a lever and operates the butterfly valve in the intake manifold. The governor is fully enclosed and is sealed, and it cannot be changed without the knowledge of the owner.

Clutch and Driving System.

The clutch is a multiple-disc dry type, composed of six plates faced on either side with anti-friction material and six steel plates. This construction has been used for four years and is stated to be very efficient and enduring. The gearset is a selective design, having three forward speed ratios and reverse, with large shafts and gears of nickel steel, heat treated, mounted on Timken roller bearings. From the gearset the driving shaft extends to a bearing mounted beneath a sturdy frame cross member, this sufficiently reducing the length to prevent "whipping", and thence with two universal joints to the telescopic joint with which it is coupled with the worm shaft in the rear axle. The rear axle is full floating and is the well known David Brown type. The housing is of steel, the large centre section having a cover plate on which is mounted the worm, gear and differential. When assembled the entire unit is installed or removed from the axle housing, and after the original adjustment no further attention is necessary. The axle shafts have clutch plates that engage with plates in the rear wheel hubs. The full load is carried on the axle housing, and the shafts may be removed by taking off the hub caps. The axle housing is constructed with a very large margin of safety and carries the brackets for the emergency brake shafts.

Frame, Springs and Other Details.

The frame is a pressed steel channel section with cross members of the same material, strongly reinforced with gusset plates, and the brackets of the rear springs are tied by tubular members that prevent spreading and give rigidity to the frame. It is suspended on semi-elliptic springs, the front set being 40 inches length and 2½ inches width, with eight leaves, and the rear set 48 inches length and three inches width with 11 leaves. The forward axle is an I section of drop forged steel of large proportions. The artillery type wooden wheels have two-inch spokes forward and 2½-inch spokes rear, are shod with 36 by four-inch solid band tires forward and dual tires of the same size rear, and are mounted on Timken roller bearings. The steering gear, a worm, wheel and shaft construction, is placed on the left side, and is provided with ample means of adjustment for wear. The wheelbases are 144 and 162 inches, with 58½ inches tread. The turning radius of the short chassis is 25 feet and of the long chassis 29 feet. The speed shifting and emergency levers are in the centre of the footboard and are operated by the driver's right hand.

Both sets of brakes operate on the rear wheels, the service brake, actuated by a foot pedal, contracting on drums 16¾ inches diameter, and the emergency brake shoes expanding within the drum. The speed of the machine is 16 miles maximum, 9.1 miles on second ratio, and 4.75 miles on low. The fuel consumption is rated as from nine to 10 miles to the gallon. The fuel tank capacity is 20 gallons.

Much care has been taken to insure the lubrication of the chassis and grease cups and oilers of liberal proportions are provided for all moving parts. A small instrument board is mounted on the last cylinder of the motor that is visibile through an opening in the dash. This is made of metal and carries a pressure gauge for the motor lubricating system, a short-circuiting switch for the magneto, a carburetor adjustment (if the carburetor is to be adjusted from the dash) and a speedometer. The speedometer is operated by a gear at the rear end of the gearset case, the shaft extending directly to the instrument board. This affords greater accuracy than when the shaft is driven from one of the front wheels.

EDISON PROMOTES POYER.

The Edison Storage Company, Orange, N. J., has made Charles E. Poyer its assistant general sales manager, in which capacity he will relieve Vice President and General Sales Manager William G. Bee to such an extent that he will devote more of his personal attention to electric vehicles and allow him to closer cooperate with vehicle and other manufacturers. Mr. Poyer has been identified with the Edison Company for four years, first as engineering assistant to Mr. Edison, later as assistant advertising manager, and for the past two years he managed the house lighting department, rapidly developing it from engineering and commercial viewpoints.

The Couple-Gear Freight-Wheel Company, Grand Rapids, Mich., has elected the following officers: W. C. Hopson, president; A. J. Brown and G. P. Hummer, vice presidents; M. H. Hopkins, secretary-treasurer; directors, the officers and Alexander Dodds, F. E. Brown, A. B. Knowlson, M. B. Church and M. C. Church.

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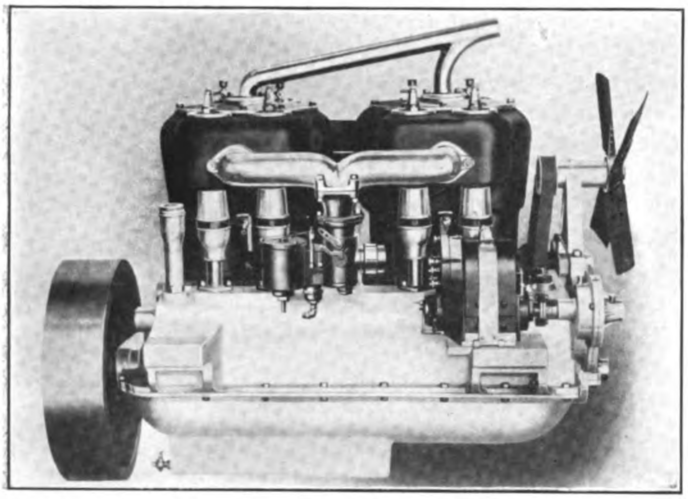
NEW WISCONSIN TYPE J HEAVY TRUCK MOTOR.

TYPE J is the designation of a new size of truck motor that the Wisconsin Motor Manufacturing Company, Milwaukee, Wis., is now producing commercially, which has bore of 5.1 inches and stroke of 5½, with horsepower rating of 41.21 by the S. A. E. formula. This is a heavy duty motor and is intended for trucks of large size. This is the most refined engine this company has developed and it is maintained to have very long service life and to have extreme economy of fuel and lubricant.

The motor is a water cooled, four-cylinder, four-cycle vertical T head construction, with the cylinders cast in pairs. In general it has the usual characteristics of the Wisconsin engines, but extreme care has been taken to obtain efficient lubrication and water circulation. All surfaces in frictional contact are large and ample margins of safety have been provided to insure against wear.

The cylinders are cast of fine gray iron with the



New Type J Wisconsin Motor, Rated at 41.2 Horsepower S. A. E. and Designed for Very Heavy Truck Service.

valve chamber, water jackets and cylinder heads integral, the cylinder heads being reinforced by cross ribs. The cylinders and valve passages are entirely water jacketed, a drain cock at the lowest level providing for complete draining of the jackets. The water inlet is directly beneath the exhaust valves. The inlet and exhaust valves are interchangeable. The top plates of the cylinders, containing the outlets, are bronze, the large openings insuring complete cleaning of the water jackets. The castings are pickled, polished, bored, reamed, seasoned and ground, special machinery being used to secure accurate and uniform work. Water pressure tests insure against leakage. The base flanges are large and reinforced by heavy bosses. The pistons are of the same material as the cylinders and are pickled, turned and ground with a taper of .003 from the skirt to the head to allow for expansion. The wristpin bosses are webbed to obtain strength. Each piston has three semi-steel rings, carefully ground to size to secure high compression, and four oil grooves, one of which in line with the wristpin carries lubricant to the bearings. The wristpin is hollow tool steel, hardened and ground, clamped in the connecting rod and oscillating in the piston bosses.

Rods, Crank and Camshafts.

The connecting rods are I section drop forged steel with extra length babbitt lined bronze bearings in the big ends, adjustable with copper shims and secured with four bolts. The crankshaft is chrome nickel steel, with the flywheel flange integral, heat treated and ground to size. The two camshafts are 40-point carbon steel forgings with the cams integral, oil tempered and ground, with unusually large bearings. The crank case is aluminum, with upper and lower sections, the former being reinforced with webs. The webs carrying the main bearing extend the full depth of the case. The bearings are retained by through bolts. The bolts retaining the cylinders are provided with collars that hold them in place, so the cylinders may be removed without taking off the lower section of the crank case. The timing gears are enclosed in an oil-tight compartment at the forward end of the case, and by removing the cover the camshafts can be removed. The lower half of the case is the oil reservoir.

The valve tappets are large diameter, of tool steel, of the yoke and roller type, fitted with adjusting screws and operating in phosphor bronze bushings that are retained by studs and lock washers. The valves are tungsten steel, are interchangeable, with springs retained by bevelled split bushings. The stems operate in very long cast iron guides that are milled in the centre, eliminating excess friction. The valve stems and tappets are enclosed in aluminum housings that are easily removable. The timing gears have ⅞-inch face and are lubricated by a duct through the idler shaft and an oil pocket. The gears are steel, semi-steel and cast iron and are secured to the shafts by Woodruff keys and taper pins.

Lubrication and Cooling.

Lubrication is by a gear driven pump on the outside of the lower section of the crank case and operated by spiral gears from the camshaft. The oil is forced to a main duct cast integral with the crank case and thence distributed by ducts in the web to the main bearings, and then carried through the hollow crankshaft to the connecting rod bearings. The excess oil thrown off by the connecting rods lubricates the cams, camshafts, valve tappets, piston and cylinder walls. A ball and float gauge indicate the level of the lubricant in the reservoir. The water circulation is by a bronze water pump through inlet and outlet manifolds that are solid castings, held by studs and split washers. The ball bearing fan is mounted on an adjustable bracket and is driven by a flat belt from a pulley

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on the pump shaft. The fan is a one-piece steel stamping with a spider and hub of pressed steel. The pump and magneto shafts are fitted with Oldham couplings and the magneto is mounted on a bracket that will take any make of magneto.

The bearings other than the main and connecting rod bushings are phosphor bronze, are large and have oil grooves and oil pockets to insure lubrication. All bearings are broached and scraped to fit. The priming cocks are bronze and are fitted into the valve covers. All bolts and nuts are S. A. E. standards and the larger nuts are castellated and secured with cotter pins. Extreme care is taken to secure complete lubrication. After the motor is assembled it is run on a belt and put on a test block, run on its own power and tested carefully idle, and is tested as to power and efficiency by a hydraulic testing machine. The motor may be fitted with a Pierce governor. The supporting arms are cast integral with the crank case and are either 17¾ inches by three inches for sub-frame or 27 by five inches for main frame mounting.

LOW BODIES FOR TRUCKS.

Hoagland-Thayer, Inc., Newark, N. J., are manufacturing electric industrial trucks, which are featured by four-wheel steer, front wheel drive and extreme low bodies. The vehicles are made in three types. A and C are standard platform, B is the regulation baggage form, and D has a dropped frame and small rear wheels, permitting a low floor.

These trucks are all of two-ton capacity, have a speed of seven to eight miles an hour light, and from five to six loaded. One of the platform types and the baggage truck have double-end control, the others being driven from one end only. The motors on types A and C are 1¼-horsepower, and those on the other types 1¾. A special feature is the use of high-grade anti-friction bearings at 20 different points on each vehicle.

TRUCK FACILITATES SHIPPING.

The Booth-Kelley Lumber Company, which operates a mill at Springfield, Ore., but which, in order to secure a satisfactory freight rate, must ship from Eugene, has put in service a three-ton Packard truck, especially built for handling lumber, being loaded and unloaded by machinery and without the driver leaving his seat. A round trip can be made every hour, on which schedule an approximate total of 35,000 feet of lumber a day can be delivered.

SPLITDORF'S LONDON CHANGE.

The Splitdorf Electrical Company, Newark, N. J., is removing its London, England, office to 162 Great Portland street, West.

INTERURBAN MOTOR ROAD.

Illinoisians Project Route for Exclusive Traffic 60 Miles Long.

A novel and yet seemingly entirely feasible project to create an exclusive route for the operation of motor vehicles between Quincy and Baylis, Ill., 60 miles apart, has been proposed by Dr. G. A. Lierle of Burton, Ill., who has interested the citizens of a number of communities, who have given it such support that a very careful investigation will be made.

Quincy is a city of more than 40,000 and is of considerable commercial importance, and the means of communication between that city and Baylis are insufficient and unsatisfactory. Dr. Lierle has proposed that a company be formed that will construct what will in effect be a private road between Quincy and Baylis, which shall have two cement-surfaced paths, with connections at frequent intervals at which vehicles could cross from the one path to the other.

The proposition comprehends the use of the road by vehicles owned by the company, which will operate both passenger and freight services, making regular trips as frequently as patronage shall demand between the terminals and all of the intervening points. The belief is that a 20-foot right of way would be sufficient, and that because of the use of motor vehicles minimum grading would be required.

The cost of acquiring the right of way, building the concrete paths and general construction work has been estimated at $3000 a mile, and on this road the projectors believe that there would be minimum operating cost and fast time could be made. Having exclusive right on the road, there would be no interruption of traffic, the schedules could be maintained, and service could be adapted that would best convenience the people of all the communities. The projected route is through a highly developed farming country and estimates made of the possibilities from such a project have greatly interested the people.

Plans have been made to survey the route as early as the weather shall permit, and when the cost has been approximated the proposition will be placed before the people of the different communities, the expectation being that business men will give it liberal support. The statement is made that such a road would cost from 25 to 33 per cent. of an interurban railroad, that the operating expense would be comparatively small, and the people would have a service they could absolutely control.

Motor trucks and other shipments intended for the belligerent nations are accumulating on the piers of the Atlantic steamship companies, which have been forced to suspend some of their sailings. The wharves along the Hudson, on the Jersey side, especially, are in a congested condition.

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MOTOR TRANSPORTS IN THE EUROPEAN WAR.

Comparisons of the Different National Plans for Obtaining Equipment for the Army Service and the Types Proven to Have Greatest Utility.

PRACTICALLY the only motor truck information obtained in Europe relates to operation of trucks in warfare. This, of course, is only natural, as the whole of Europe is concerned in the war in one way or another. The statement that this is a motor transport war is made on every hand, and Horace Wyatt in his "Motor Transports in War", published by Hodder & Stoughton, London, England, has compiled an interesting group of facts that will give the motorists of neutral governments an excellent insight to conditions that really exist.

The book makes an interesting survey of the uses of the motor vehicle itself, especially the heavier types. The special qualities from a military point of view are examined, and an account is given of the work accomplished with mechanical transports at recent army manoeuvres, both in England and on the continent. The value of the motor vehicle for ambulance purposes is treated at some length, and a statement is made of the requirements for machines designed to carry the sick or wounded, whose physical sufferings may be aggravated by the use of the wrong types or by faulty equipment.

Mr. Wyatt cites experiences with motor transports in the Turco-Italian war in Tripoli and the Balkan campaigns, as reported by eye witnesses, and deduces several interesting lessons. In regard to the transport of ammunition and artillery, a tribute is paid to the successful efforts of Britain's French allies, "who have for this special purpose given much encouragement to the development of internal combustion tractors driving all four wheels". Armored autocars also come in for a careful analysis, and the points brought out are well illustrated by original photographs and drawings.

In considering the British subsidy type the importance of a uniform system of control is emphasized. As a testimonial to the excellence of the war department's requirements, the fact is quoted that one leading British maker of heavy motor trucks has adopted the war office system of control as a standard for all vehicles, whether of the subsidy type or not. The question of final drive is also considered, and on this point Mr. Wyatt says: "At a rather later date it may be worth while to consider whether experience has not demonstrated the possibility of combining with a full subsidy scheme a modified scheme insisting only on vehicles of the right load capacity, and the adoption of all details of the standard control. In this way a very fairly adequate reserve would be brought into being without any considerable trouble".

It is pointed out that so far as continental schemes have been concerned, that these have had, to a large extent, to depend upon their financial clauses for the provision of efficient mechanical transport. Without particularizing, it is stated that in several, if not all cases, these schemes have proven inadequate, a fact that throws into relief the extent to which British military authorities have been served by the enterprise of commercial users in England. The German scheme, which was inaugurated in 1908, was introduced with the statement that it was "A scheme for popularizing the use of mechanical transport". Commenting on this, Mr. Wyatt says: "In other words, a scheme for persuading business houses to adopt a species of transport which, without government aid, would represent an uneconomical and consequently undesirable feature of an industrial concern".

In contradiction to the British three-ton and 30-cwt. types, the German government decided in favor of heavy motor trucks capable of carrying four tons and hauling an additional two tons on a trailer, which necessitated the high subsidy of approximately $2250, spread over a period of five years. The latter part of the book deals with the advantages of subvention schemes and the importance of standardization and equipment, although by no means overlooking the limitations of the British scheme. Due account is taken of the fortunate position occupied by England in the wonderful development of motor transport in commercial circles, and especially of the influence of London on the movement. In this respect the author points out the great disadvantages under which continental countries have labored owing to the restricted use of heavy motors in civilian circles.

The closing chapter of "Motor Transports in War" pays a tribute to the work done by the chief motoring organizations in England, in the provision of lists of vehicles suitable for military work, and to these bodies the war department is certainly indebted, to a great extent, for the promptness with which the needs of several departments of the public service were met. Mr. Wyatt has made a thorough study of the question of military transport, contributing a special paper on the subject to the Imperial Motor Transport Conference held in London in 1913. In his capacity of honorary secretary of the Imperial Motor Transport Council and consulting editor of Motor Traction, he is in a unique position to present, as he has done in his latest work, an authoritative survey of the work of the motor truck under war conditions. The book is well worth the perusal of every American motorist, presenting, as it does, each phase of the use of motor transports in the European war.

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OUTPUT OF TRINIDAD OIL FIELDS.

John Cadman, D. Sc., M. Inst. C. E., in a paper ead before the Institution of Petroleum Technologists, London, England, recently, told of the fuel within the British empire. Mr. Cadman's paper was entitled "The Development of the Trinidad Oil Fields", and he told of the work that had been done on this island, and all that remained to be done before the possibilities can be accurately assessed. The zones which have so far been examined lie in the southern area, while indications point to the presence of oil north of the central range and elsewhere. The history of the development of the fields to the present time was given by Mr. Cadman in the following:

Year	Imperial gallons output	Feet drilled	No. of wells
1902	....	1,015	1
1903	....	2,665	3
1904	....	1,904	2
1905	....	....	..
1906	....	2,229	2
1907	....	2,837	4
1908	5,900	3,758	4
1909	2,000,000	5,927	6
1910	5,000,000	7,321	7
1911	9,985,740	14,485	14
1912	15,288,162	40,418	46
1913	17,626,563	42,552	44
1914	22,523,660	41,933	41
Total	72,430,025	167,044	174

From 1902 to 1907 Mr. Cadman stated that it was impossible to secure production figures, as up to 1908 all the oil obtained was used under boilers in the field. He pointed out that there has been a material increase in production during the past three years and, although the figures are not available for the current year, it seems probable that the output will be double that of 1914. Up to the present time about half of the wells bored have failed to produce, while many that have yielded oil have temporarily ceased to yield because of "sanding up". This cause of diminished production is one of the greatest obstacles met with in working the Trinidad oil fields. The "sanding up" is caused by the occurrence of oil sand under other material of similarly unstable characteristics, accompanied by gas under excessive pressure. In some cases the gas has interfered with work so much as to make it impossible to keep wells under control. In many cases, says Mr. Cadman, the gas has seriously handicapped operations by choking the pipes with sand. It is only after two or three months that the volume of oil from a new well steadies down, and "sanding up" can be avoided.

There are many other difficulties in connection with the industry in Trinidad, including transportation and the prevention of malaria. As to the latter, considerable progress has been made, while in the case of the former the making of tracks and roads so that machinery can be conveyed to the drilling sites is no easy matter. This work is limited to the dry season, and consequently the progress is extremely slow. It is pointed out that one of the reasons which makes the development of the Trinidad fields extremely important to motor users is the high percentage of petroleum spirit obtained from the oils from many of the wells. Oil obtained from the lower sands is found to have a specific gravity of .810, and to contain 40 per cent. of petroleum spirit. Comparatively little has been done as yet in the way of developing refineries in the colony. This has been due to the comparatively small production, but as greater output is now assured considerable progress in refining may be anticipated.

Little has been done to obtain rights to construct or to promote construction of pipe lines for the conveyance of oil from the wells to the shipping ports or markets though legislative authority can be now assured. Mr. Cadman sums up by saying that much good work has been accomplished, many difficulties have been overcome, many new problems have been solved and the potential value of Trinidad as a source of petroleum has been unquestionably demonstrated.

BUSINESS BOOMING IN SCOTLAND.

All branches of industry in Scotland are working at full time. This is especially true of the motor manufacturers, and from the latest reports the automobile and truck concerns are running at their capacity. Owing to the British war office demands the commercial car makers have been unable to fill the orders on hand, even by working day and night, and from all indications there will be no let up in these orders for some time to come.

Owing to this difficulty, a large firm handling supplies and making a specialty of repair work, is arranging to place on the market in the very near future a type of utility wagon which its experience has shown to be in large demand. This machine, which will have a load capacity of three to 3½ tons, will be driven by a 32-horsepower, four-cylinder engine. Power is transmitted through an ordinary leather faced cone clutch to a gear box, giving four speeds forward and reverse. The rear axle is of nickel steel, and the driving chain tension is variable within limits by means of strong tubular adjustable radius rods. The radiator is of special design, with bowed front, and the bonnet is inclined, giving the front of the machine a neat appearance.

RUSSIA DEPOSITS $40,000,000.

The Russian government has placed a large number of orders for motor trucks with British manufacturers, and a majority of the English plants are working day and night to fill these and orders from their own government. Russia has deposited $40,000,000 in gold with the Bank of England, and in consideration of this the British government arranged to discount under government guarantee Russian treasury bills to the further amount of $60,000,000. By this plan the funds of the Russian nation in England are, or were, equivalent to $100,000,000.

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BIG PRIZES FOR BEST MOTOR AMBULANCE BODY.

INTERNATIONAL recognition, and a reward of £1000 will be won by the person who shall design a field motor ambulance body that will be best adapted for installation on differing chassis and for use in army service. Impelled by purely humanitarian interest, the Wellcome Bureau of Scientific Research, which was founded by Henry S. Wellcome, an eminent English citizen, has placed a fund of £2000 at the disposal of a committee designated as the Ambulance Construction Commission to stimulate the creation of one or more designs for ambulance bodies, and this organization has announced that it has offered this sum in three prizes to designers throughout the world who care to engage in this competition.

The statement is made that Mr. Wellcome, because the present European conflict is the first war in which motor ambulances have been extensively used, and the machines now in service have been largely extemporized, desires to concentrate the endeavors of practical minds to developing equipment that will be more practical and better adapted to conserving life on battlefields.

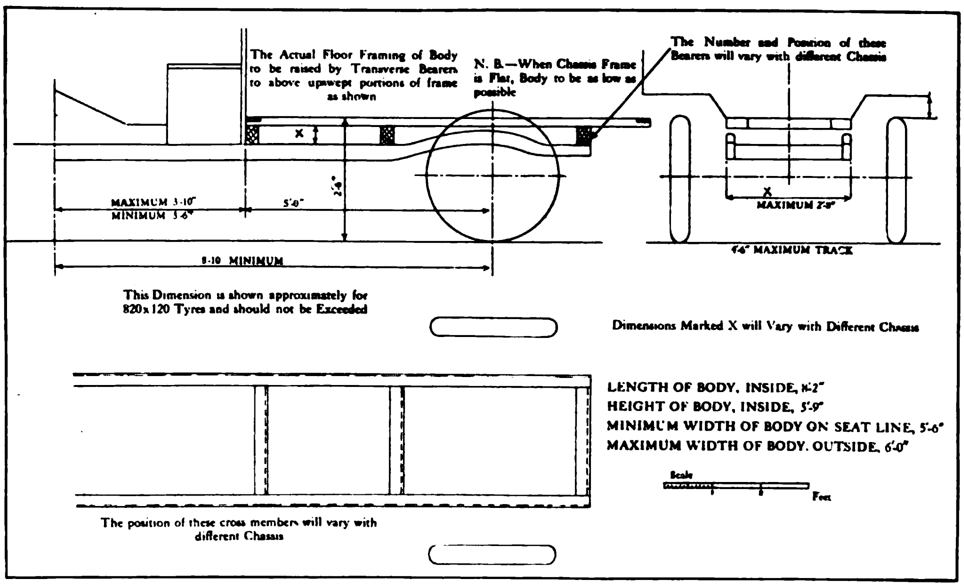
The reason for stimulating competition in body designs rather than a complete vehicle is that only in the event of war will field ambulances be needed in large numbers, and as chassis of differing types will be available, the real need is a standardized type which can be quickly constructed and installed on chassis of approved dimensions. With a satisfactory design nations could in an emergency soon provide a sufficient number of ambulances to afford comfortable transportation from fields of battle to hospitals. One special form of chassis would limit the construction of machines, and retard suitably equipping an army with ambulances, but chassis on which a perfected body could be installed could be collected in a very brief period. There is a belief that in addition to one or more bodies of special excellence ideas may be secured that can be incorporated into a single type that may be approved by the commission.

The Ambulance Construction Commission has been appointed to collect, judge and report upon plans, designs and ideas that may be submitted to it, and its functions have been made international in character, so that it may obtain information from all sources and give to the entire world the benefit of the data it shall obtain.

This commission is headed by Sir Frederick Treves, a surgeon of world-wide repute, who represents the British Red Cross Society, and associated with him are the director-general of the medical department of the royal navy, the quartermaster-general to the forces and the acting director-general of the army medical service, representing the British war office; Sir Claude Macdonald and Sir John Furley, representing the St. John Ambulance Association, and other men prominent in civil and professional life, the commission consisting of 11 in all.

The commission has decided that it will offer prizes of £1000, £500 and £300 for the best designs for bodies for and improvements in motor field ambulances and the remaining £200 of the award will be distributed in smaller sums at the discretion of the commission. The first, second and third prizes are for a complete design, but the commission reserves the right to award the whole or any part of the £200 unspecified for details, such as ingenious spring suspension, method of storing arms or equipment, lighting, means for self-haulage, etc., or an invention that can be applied to any chassis.

The statement is made relative to the ultimate object of the commission, that since it is desired to improve the existing types of ambulance bodies, and to produce, if possible, a standard pattern body of perfect design which shall fit standard chassis, all designs submitted by competitors shall become the property of the commission. Apart from the prizes there shall be no payment made for designs, which the commission may, if it approves of them, publish in a form that may be determined later on. These designs can then be used for the cause of humanity. Arrangements will be made which will insure tests by the government and existing ambulance associations to utilize any idea upon which the commission may report favorably, and it is Mr. Wellcome's inten-



Sketch Showing the General Chassis for Which the Competition Is Expected to Develop a Standardized Type of Body.

eventually to publish in a suitable illustrated form, er the auspices of the Wellcome Bureau of Scien- Research, such material and information as the mission may deem worthy of preservation as a nanent record.

The conditions for this competition are:

A) Relating to construction.
—The body must carry, in comfort and safety, four wound- ying on stretchers of the British army regulation pattern vas, six feet; poles, seven feet nine inches; width, one foot nches; height, six inches; weight, 30 pounds), or eight nded sitting, or two lying and four sitting, in addition to driver and orderly attendant.
—The patients must be sheltered from weather and sun, due regard to ventilation. The driver and orderly must rovided with adequate shelter.
—The vehicle must be capable of being loaded from the nd level by four or fewer bearers.
—Every patient must be accessible for attendance from side without being shifted from his position.
—There must be a vertical space of not less than two feet een the upper and lower tier of patients.
—There must be sufficient windows to ensure ample light ay, and means of lighting the interior by night.
—There must be means for the orderly, on the box or else- re, to see every patient during running.
—There must be means of carrying the arms and equip- t of the patients, some dressings, water and small quan- s of hot liquid in the vehicle.
—A vertical line through the centre of gravity of the body t fall between the axles, whether the body is laden or ty. The centre of gravity of the body must be kept as as possible.
0—The body must be kept as light as possible compatible adequate strength.
1—The materials of construction should be as non-inflam- le as practicable. Competitors may be called upon to sub- samples of construction.
2—The body must be of such a design that it shall fit a sis, the essential dimensions of which are shown in the ac- panying drawing.
3—In making the award the cost of construction of the will be taken into consideration.
B) Any number of different designs may be submitted by one competitor.
C) Designs may be submitted on any date up to and in- ing June 30, 1915. No designs received after that date will onsidered.
D) All designs will become the property of the commis- , which will take steps to protect the patents.

The suggestion is made that competitors should ster the packages containing designs submitted. etter of acknowledgment will be sent on receipt of a competing design. If this letter is not received r the lapse of a reasonable time, competitors should nmunicate with the secretary, who can be ad- ssed, as can the commission, at 10, Henrietta et, Cavendish square, London, W., England.

The accompanying drawing and the foregoing con- ons make clear that the commission is desirous of aining standards designs that can be installed on ering chassis, the dimensions being: Inside gth of 98 inches, height of 69 inches, minimum th of body at seat line 66 inches, and maximum th of body outside of 72 inches; this to be fitted on hassis having a minimum of 42 and a maximum of inches between the dash and the back of the ver's seat, and 60 inches between the back of the ver's seat and the centre of the rear axle, this al- ing 38 inches of the rear of the body back of the tre of the rear axle. The maximum distance be- en the rear springs is 32 inches, and the maximum ad is 54 inches.

The interest in this competition ought to be very oad, and there is reason to believe that numerous nerican body designers will enter into it, quite as as from the humanitarian aspect of the proposition as from hope of benefiting through the award of prizes. In this connection emphasis should be made of the fact that American body designers have mani- fested remarkable genius, and developed types that have been found extremely efficient and serviceable. The practicality of construction and equipment, rather than elegance and finish, will probably be de- termining factors with the commission, for hard and constant service, quite different from ordinary use, is a certain result of military operations. Designers de- siring additional information relative to the competi- tion can obtain it from the commission at the address stated.

GOODYEAR S-V TRUCK TIRES.

The development of the S-V truck tire by the Goodyear Tire and Rubber Company is stated to have required eight years of research and experiment, and the design now marketed is believed by the company to be the best of the kind that has ever been produced for service.

Statement is made by C. W. Martin, Jr., manager of the motor truck sales department, that in the ex- perimental work 29 different types were built and test- ed, an idea of the task being gained from the fact that no less than 74 structures of one type were tried be- fore the precise determination desired was obtained. The S-V tires were decided on as best meeting the re- quirements for heavy service, and these have been tried for a year and a half, there now being 2100 in use in different sections of the country.

The S-V tire is pressed on the rim, has absolute security, is interchangeable, there are no rights and lefts, and it cannot be installed wrong. It weighs less than other tires and is maintained to afford extreme mileage.

REPUBLIC INCREASES CAPITAL.

The stockholders of the Republic Motor Truck Company, Alma, Mich., maker of the Republic trucks, have increased the capital of the concern from $50,000 to $250,000, and practically all of this has been sub- scribed by citizens of Alma, who provided nearly all of the capital when the company was originally or- ganized. The concern has gained consistently in business and the plant is now producing an average of 12 machines a day. The officials hope to increase this output considerably.

The Kelly-Springfield Tire Company has appoint- ed Maurice L. Switzer advertising manager, and he is attached to the general offices of the company at 229 West 57th street, New York, N. Y.

The Kansas City, Mo., Motor Car Dealers' Asso- ciation has elected as president Estel Scott, manager of the branch of the General Motors Truck Company in that city.

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MOTORIZING NEW YORK'S FIRE DEPARTMENT.

Plan to Convert Steam Pumps by the Use of Tractors and Have Other Equipment Motor Driven—Change Will Be Half Complete by End of 1915.

THE policy of Robert Adamson, fire commissioner of New York City, one of the most progressive city department heads in this country, for completely motorizing the New York fire department is being consistently carried out. When a writer for one of the New York leading daily papers, Mr. Adamson advocated motor equipment for all city departments, and later as secretary for Mayor Gaynor, he was largely instrumental in influencing the Board of Estimate and Apportionment in making liberal allowances for this work. He was appointed fire commissioner by Mayor Mitchell.

Commissioner Adamson states that if the board grants his request for $308,000 for the conversion of horse-drawn fire apparatus to motor driven, and for the purchase of motor apparatus, by the end of 1917 no horses will be in use in the fire department of New York City. At the present time the department has 227 motor apparatuses, classified as follows:

Gasoline propelled steam fire engines	51
Gasoline propelled pumping engines	2
Electrically propelled steam fire engine	1
Gasoline propelled high-pressure hose wagons	24
Gasoline propelled regulation hose wagons	8
Gasoline propelled combination chemical and hose wagons	33
Gasoline propelled boat tender	1
Gas-electric propelled hook and ladder trucks	4
Gasoline propelled hook and ladder trucks	39
Gas-electric propelled water towers	3
Gasoline propelled water towers	2
Total automobiles	39
Total delivery trucks	20
Total	227

In addition to these 227 motor apparatuses, there are 445 horse-drawn units. The department has contracted for 23 pieces of motor apparatus, and beside these 92 automobile units will be ordered this year. By the end of 1915 Commissioner Adamson will have a total of 342 motor apparatuses under his control. Regarding the situation in New York City, the commissioner says: "Perhaps nothing so forcibly illustrates our views regarding motorized traffic—for both economy and efficiency—as this one statement, and if one will but review the transition that has been in progress during the past four years I think he will realize that it is the result of no sudden fad on our part, but through careful observation of practical experience. As compared with horse-drawn apparatus, motor apparatus is so much superior that it would be difficult to tell in just so many words the many ways in which it has proven its advantages. Perhaps the greatest benefit of motor apparatus is in answering second or greater alarms.

"For each succeeding alarm after the first an apparatus comes from a further distance. What are known as second alarm companies travel from three-quarters of a mile to a mile. Third alarm companies travel from a mile to a mile and a half, and sometimes two. Fourth alarm companies travel from two to four miles, whereas on special alarms it is possible and has occurred that horses have travelled from eight to 10 miles. This occurred on at least two occasions when there were large fires at Coney Island. The weight of a three-horse engine is about 11,000 pounds, and of a three-horse hook and ladder truck from 14,000 to 17,000 pounds with men and equipment. Fire horses can cover the first half mile in from 2½ to three minutes. Thereafter their speed lessens perceptibly on account of the great weight. The horse-drawn company—responding to a third alarm fire—would be from 12 to 15 minutes in covering the distance between the company quarters and a fire, and a fourth alarm company from 25 minutes to an hour.

"Motor apparatus does not become tired and maintains the rate of speed. The specification requirements of the New York fire department call for a consistent speed for a half hour at the rate of 25 miles an hour. This would mean that it would be able to get to a second alarm fire in about four minutes and to a third or greater alarm fire in about five to 10 minutes, or at the same rate. In this quick response there is another very notable feature that is not understood by outsiders. That is, that the headway made by a fire between the arrival of companies on various alarms would be greatly decreased. For instance, assuming that horse-drawn apparatus is in use, the second alarm companies might be so long responding, and the fire gain such proportions that a third, and perhaps a fourth, alarm would be necessary, while with motor apparatus the second alarm companies would arrive so quickly that a third and fourth alarm would be unnecessary.

"The cost of maintenance and operation is another factor which very strongly favors motors. The expense of upkeep, feed, horseshoeing, etc., averages yearly $900 for a three-horse apparatus. The cost of upkeep, maintenance, etc., for the gasoline tractor is about $420 a year; thus there is a saving of $480 a year on one unit. The life of the tractor is 20 years, but no horse can endure the work of fire department service more than seven years, so that a fire engine will wear out at least nine horses while another engine is wearing out one tractor. We estimate that $485.40 a year is saved on every change of engine from horse to automobile motive power. The annual saving on a hook and ladder truck is $414.60, and on an engine tender $266.15. The wise policy of adopting tractors as motor power instead of buying all new equipment, results in a saving to the city in each instance of about $5000. An ordinary 700-gallon gasoline propeller and

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gasoline pumping engine costs about $8500. If this class of apparatus was adopted entirely the present steam engines, all of which are in first-class condition and have a service life of from 20 to 30 years with ordinary repairs from time to time, would have to go to the scrap heap.

"The efficiency of steam pumping engines over gasoline propelled is indisputable. The problem of retaining the best feature of the pumping engine and at the same time abolishing the use of the horse for motor power has been solved by the use of tractors costing about $3600. These are coupled to the steam pumping engines by removing the front running gears. This converted equipment also meets and solves one of the serious conditions developed with the gasoline propelled and pumping engine, that of thawing frozen hydrants. All steam engines in the New York fire department carry a length of thaw hose. When a hydrant is found frozen the thaw hose is attached to the engine's steam exhaust and the free end run into the hydrant, with which within five minutes from 20 to 25 inches of ice can be thawed. Of course, this cannot be done with gasoline engines.

"Probably one of the most striking economies represented in motorized apparatus, especially with land values steadily advancing, is the economy and adaptability of space through the use of motors in place of horses. With horse equipment double companies require a house 40 by 50 feet wide, and a 25-foot house is required for a single company. This width is necessary because stalls are arranged along the wall on each side, taking up about 11 feet of space. With motor units the apparatus of a double company can easily be put in quarters 25 feet wide.

"All these are practical considerations of vital importance. Experience has pointed to the truth, and today we are fully convinced that motors are the hope of the future. The horse has served faithfully and well, but in an age of efficiency, sentiment must step aside for progress. The expenditure of this appropriation, if granted us, will undoubtedly place New York City in the first rank with other municipalities as having its fire department equipped with the latest type of motor driven apparatus".

Commissioner Adamson has prepared a statement of the cost of maintenance and operation of motor propelled and of horse-drawn apparatus, which follows:

MOTORIZED ENGINE.

Tractor cost, $3600; life, 20 years.

YEARLY UPKEEP COST.

Depreciation	$180.00
200 gallons gasoline	22.00
50 gallons lubricating oil	12.60
Repairs	200.00
Total	$414.60

HORSE DRAWN ENGINE.

Horse's cost, $350 each; life, seven years.

YEARLY UPKEEP COST.

Depreciation of three horses at $50 each	$150.00
Forage, veterinary services, shoeing, stable equipment, harness, etc., for horses at $250 each	750.00
Total	$900.00
Saving per year on one engine	$485.40

MOTORIZED HOOK AND LADDER TRUCK.

Tractor cost, $3600; life, 20 years.

YEARLY UPKEEP COST.

Depreciation	$180.00
200 gallons gasoline	22.00
50 gallons lubricating oil	12.60
Repairs	200.00
Total	$414.60

HORSE DRAWN HOOK AND LADDER TRUCK.

Horse's cost, $250 each; life, seven years.

YEARLY UPKEEP COST.

Depreciation of three horses at $50 each	$150.00
Forage, veterinary services, etc., as above	750.00
Total	$900.00
Saving per year on one truck	$485.40

MOTORIZED TENDER.

Tender cost, $3985; life, 20 years.

YEARLY UPKEEP COST.

Depreciation	$199.25
200 gallons gasoline	22.00
50 gallons lubricating oil	12.60
Repairs	100.00
Total	$333.85

HORSE DRAWN TENDER.

Horse's cost, $350 each; life, seven years.

YEARLY UPKEEP COST.

Depreciation of two horses at $50 each	$100.00
Forage, veterinary services, etc	500.00
Total	$600.00
Saving per year on one tender	$266.15

CHASE TRUCK USED BY SYRACUSE.

A novel type of automobile garbage collection has been instituted at Syracuse, N. Y., by which the city has eliminated the nuisance of open wagons scattering garbage through the streets. Two Chase trucks, made by the Chase Motor Truck Company, Syracuse, N. Y., are used for this service. These are three-ton capacity and carry 108 cans, which weigh when filled about 100 pounds. But as the cans are not always full the average load is about 3½ tons. Each truck has a crew of six men, two being stationed at all times on the folding running boards, who place the cans as they are brought from the yards by the four collectors.

When loaded, the trucks go to the reduction plant outside of the city, where the drivers and two helpers unload the cans. These helpers stay at the plant; part of their work being to wash the cans and have them ready for the next day's service. The trucks are neat and attractive in appearance, and if the system, which is in the experimental stage, proves satisfactory, a sufficient number of trucks will be purchased to extend the servcie over the entire city.

MOTOR SERVICE FOR BROOKLYN.

William E. Kelly, postmaster, Brooklyn, N. Y., expects to inaugurate motor car service for the Flatbush and Bath Beach sections of that city in the very near future. The present plan is to give letter carriers $1000 with which to purchase automobiles so that they may cover the ground to better advantage, and expedite handling the mail. This proposition has Mr. Kelly's approval, but it must be officially confirmed by officials at Washington before it shall become effective.

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FEDERAL SALES CONVENTION.

Third Annual Gathering of Distributors at Detroit a Large Success.

Three days were devoted to the third annual convention of the selling organization of the Federal Motor Truck Company, which was held at Detroit, Mich., Jan. 20-22, the activities being divided between the factory and Hotel Pontchartrain, which was headquarters for the visitors. The delegates represented all sections of the country. They were conveyed between the hotel and the factory in a handsome 'bus body mounted on a Federal chassis.

The sessions were presided over by Vice President and General Manager Martin L. Pulcher, and the proceedings included talks by the heads of the different departments of the company and the discussion of subjects that would be beneficial to the sales force. The policy of the company was considered from various aspects and the condition of the markets of the different sections of the country was carefully analyzed, the purpose being to obtain an accurate estimate of business possibilities with a view of planning the selling campaign to be most productive in every localtiy.

In addition to these, the results obtainable from suggested practical methods were considered at length, among them being the subject of time payments, which was presented by H. B. Vincent of Chicago; "Maintenance Operating Plans" and "How to Secure and Handle Big Business", which were introduced by C. K. Thomas of New York, and "Competition with Local Truck Manufacturers", which was specialized by H. S. Dunlavy of Chicago. Harry Whitten of Lynn, Mass., dealt at length with fire department apparatus and the possibilities in this line. One subject of importance was that of affording service for machines in one territory which were sold in another, and the evils of price cutting was also given attention.

The entertainment of the visitors included a theatre party, a visit to the Detroit automobile show, a tour of the Timken plants and a banquet the night of the 22nd at the Hotel Pontchartrain, at which the tables were arranged as an "F", the menu cards were specially designed and illustrated, and a pink sporting edition of "Several Traffic Views", a burlesque of the Federal Traffic News published by the company was distributed by a singing newsboy. There were numerous cabaret features.

During the convention announcement was made that the company had decided to build a 3½-ton worm driven truck, which would shortly be placed in the market. This type was determined because of the general demand of the dealers.

TRAINLOAD OF CRUDE RUBBER.

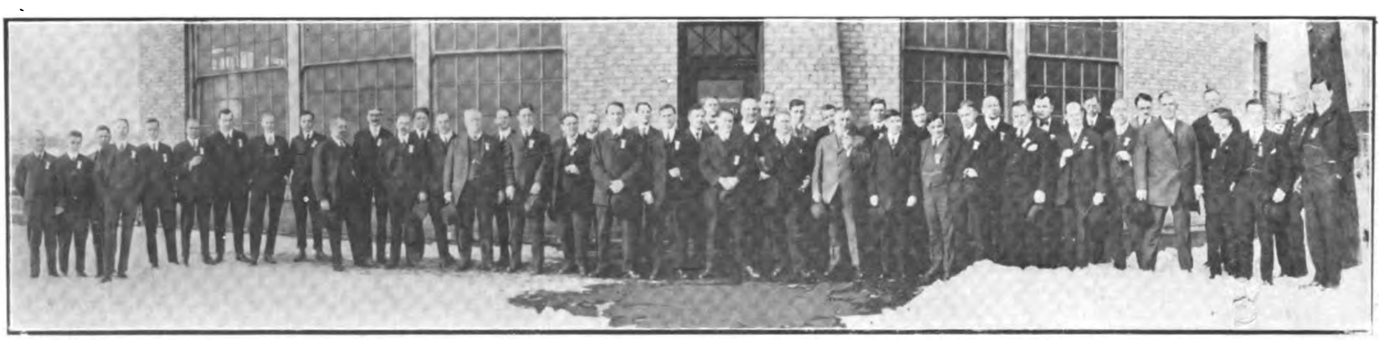
The Goodyear Tire and Rubber Company received a trainload of crude rubber at its plant at Akron, O., Jan. 22, this being the first shipment received by any American manufacturer following the lifting of the embargo placed on rubber by Great Britain. Several days later the company also received 200 tons of rubber, which was brought into New York on the steamship Lusitania, this being the second consignment.

An official of the company is authority for the statement that with these two shipments in the possession of the company, and the raising of the embargo, there was no reason to expect advance in the prices of truck tires. Had not England consented to the sale of rubber to the United States by her possessions, higher prices would have been a necessity, but unless something unforeseen eventuates the condition of the market ought to return to normal in a comparatively short time.

NEW KOEHLER AGENCIES.

The following agencies have been made for Koehler trucks: F. E. Goldsberry, Athens, O.; Elm Auto Company, Bridgeport, Conn.; F. P. Renz, Pana, Ill.; Metropolitan Auto Company, Dodgeville, Wis.; Cochran & Co., Cincinnati and Ripley, O.; McKenery & Britton, West Newton, Penn.; Rehling Bros., Decatur, Ill.; Burdett Bros., Whitehouse, N. J., and H. A. Pierson, Washington, N. J.

John V. Move, formerly associated with the Goodyear Tire and Rubber Company, has been appointed assistant general sales manager of the Kelly-Springfield Tire Company, with headquarters in Detroit.



The Delegates to the Third Annual Convention of the Selling Organization of the Federal Motor Truck Company, Held at Detroit, Mich., Jan. 20-22.

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THE A B C OF MOTOR TRUCK IGNITION.

Part XXX—Outlining the Construction and Operation of the Atwater Kent System, a Combined Form of Timer and Distributor Contained in One Housing—Features of the Automatic Spark Advance Controlled by a Simple Form of Governor.

By C. P. Shattuck.

AN IGNITION system which has been marketed for several years for internal combustion engines, utilizing dry cells or a storage battery as a source of current supply, is the Atwater Kent, the product of the Atwater Kent Manufacturing Works, Philadelphia, Penn. The first ignition apparatus brought out by this concern was a combined timer and distributor; that is, the mechanism employed for interrupting the primary current and distributing the intensified or secondary current, was incorporated in the one housing.

Improvements Noted.

Improvements were made in the system from time to time to meet the requirements of the motor vehicle designer, and at present the company is producing several types, which are distinguished by letters and numbers. Both manual and automatic spark advance are manufactured, the former being known as the type H. The type K-2 includes the automatic advance, which will be described in detail.

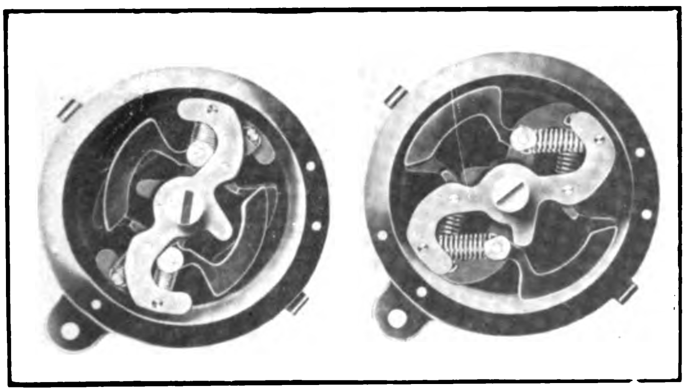

Fig. 185—Showing the Atwater Kent Governor Mechanism in Retarded Position at Left, and Fully Advanced at Right.

For High-Speed Motors.

The automatic advance system was designed for high-speed motors, and it advances the spark automatically and proportionally up to a speed of 2400 revolutions a minute. Both the manual and automatic types are adapted to motor vehicles equipped with a generator for lighting and battery charging, and are noticeable for their simplicity and durability. The advantages claimed for the Atwater Kent system are: A uniform spark at all motor speeds, automatic retard for starting, automatic advance along a regular curve, eliminating the greater part of hand regulation, and a wide range of advance for high-speed engines.

The simplicity of the system is illustrated by the drawing at Fig. 187, which shows the various elements connected. The current from the battery passes through the switch, primary winding of the coil, contact maker and back to the source of supply in a simple series circuit insulated at all points.

The simplicity of the combined timer and distributor is shown at Fig. 189. The mechanism termed the contact maker, that interrupting the flow of the primary or battery current, is shown at the left. The shaft operating it is driven at camshaft or half-crankshaft speed, much in the same manner as the ordinary timer or commutator employed with the battery and vibrating coil system of ignition.

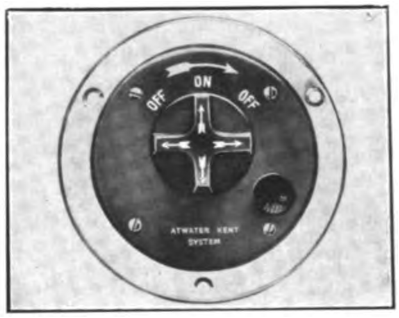

Fig. 186—The Reversing Switch.

As with the timer system the Atwater Kent housing does not rotate except when it is necessary to move it to obtain an advance or a retard of the spark. The mechanism employed to break the primary circuit is simple, as may be noted by reference to Fig. 189. One of the desirable qualities of the design is that the points establishing the primary circuit cannot remain in contact, so that in the event the switch lever be left on the "On" position, the battery cannot discharge itself as the circuit is open. This feature will be made apparent by a description of the construction and operation of the contact mechanism.

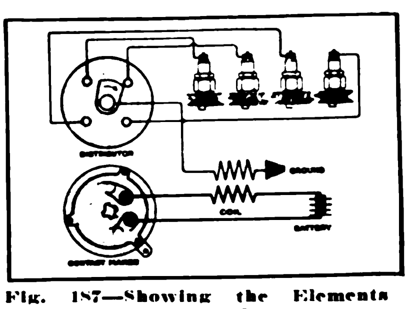

Fig. 187—Showing the Elements Connected.

The parts assembled in the case are shown at Fig. 189, and the various positions assumed by the contact maker during a complete movement are seen at Fig. 188. The components include a shaft X, which rotates in a stationary case, a contact spring D and a contact screw C. Normally the spring carrying a con-

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tact point is held away from the other or fixed point by the tension of the spring. It is because of this arrangement that the switch lever may be left at the "On" position as previously explained. Two intermediate pieces, S and E, a hammer and lifter respectively, actuate the spring carrying a contact.

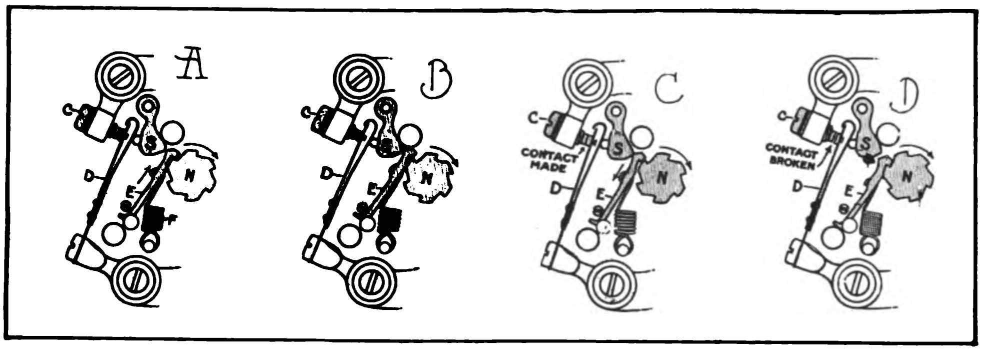

Fig. 188—Illustrating the Various Positions Assumed by the Contact Breaker Mechanism of the Atwater Kent System.

The engagement of the fixed and movable contact members is obtained by the lifter E being set in motion by the shaft N. This shaft carries a number of notches or recesses into which the hook shaped end of the lifter E engages. A coil spring F attached to the lifter pulls the latter downward and, as there is a certain amount of movement in the member N, the hook shaped end naturally drops into a notch when the motor stops, this maintaining an open circuit.

The operation of the mechanism is shown at Fig. 188. The drawing at A shows the parts in their normal position. Here the points are separated as the shaft N is in such position that the end of the lifter E rests in a notch of the shaft. The hammer S is inactive as the tension of the contact spring tends to keep it in contact with the upper end of the lifter.

Brief Contact Made.

B shows that the shaft N has rotated slightly, and clockwise, as indicated by the arrow. The hook shaped end of the lifter is beginning to rise, riding up on the rounded portion of the cam of the shaft. A further movement or rotation of the shaft N causes the lifter to move to its maximum, pushing the hammer S against the spring member D, and contact is established between the movable and fixed points. The contact is very brief, but of sufficient duration to fully establish the primary circuit.

The drawing at D shows the return of the part E to its normal position, due to the hooked end having ridden over the cam and its being drawn downward by the coil spring. The operation is accomplished so fast that it is stated the eye cannot follow the movements of the parts S and D.

The intensifying of the primary or battery current is obtained in the conventional manner by a coil, and the current is induced upon the sudden breaking of the primary circuit. The distribution of the high-tension current to the spark plugs is accomplished by the distributor, which is fitted over the circuit breaker mechanism. It is a simple construction, as may be noted by reference to Fig. 189.

The distributor proper is a simple metal blade mounted on the top of a block of non-conducting metal. It revolves with shaft of the construction, and receives the high-tension current from the coil, delivering it to the several brass pointed collectors in turn. Owing to the high voltage or pressure of the current, actual contact between the metal blade and the collector members is not necessary, and because of this construction wear is eliminated.

Durability and efficiency are features emphasized in the Atwater Kent system. The contacts are constructed of tungsten, and because of the quick separation obtained arcing is prevented. The maker states that the contact points will require adjustment only after 10,000 miles of service and replacement only after 50,000 miles of average wear. Means are provided for adjusting the contact points by removing one or more of the thin washers under the head of the screw C. The extreme durability of the contact points is held by the maker to be due to the form of switch used. This switch reverses the flow of direction of current every time the control member is turned.

Manual Control Type.

In the type providing for manual control, the advance and retard of the spark are obtained by rotating slightly the timer and distributor case. The type

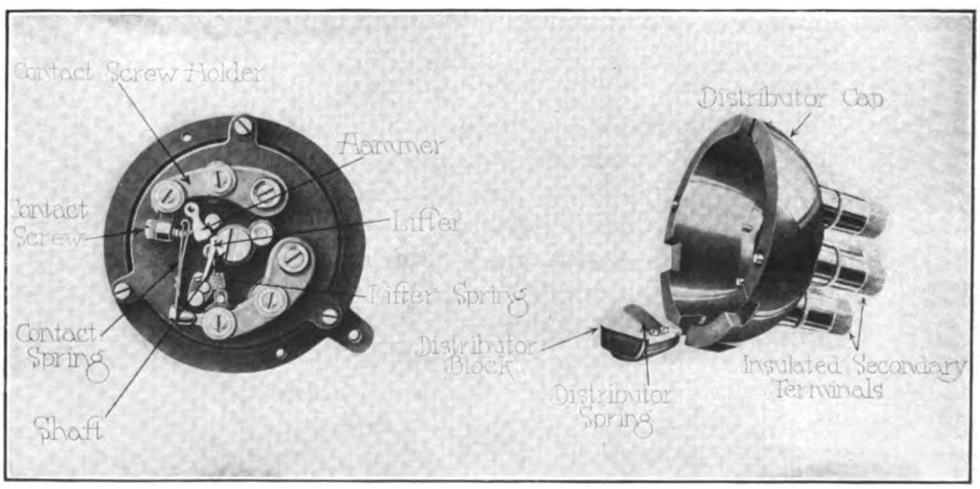

Fig. 189—The Components of the Circuit Breaker Mechanism and the Distributor of the Atwater Kent Ignition System.

H Atwater Kent system depends wholly upon this method.

The type K-2 is provided with an automatic spark

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advance mechanism, which is shown at Fig. 185. This device is a form of governor and is of simple construction. Two shafts are employed, the second being in alignment with the first. The upper member carries the contact member and distributor and the lower the governor; or in other words, the governor mechanism is interposed between the main shaft and the end carrying the distributor.

The function of the governor is to advance or retard the spark automatically. It consists of a pair ot weights that are normally retained in the position shown in the illustration at the left at Fig. 185. These weights are carefully balanced, and are controlled by springs so arranged as to exert an increasingly direct pull as the weights expand or move outward.

Operation of Governor.

The tendency of the weights to move outward or expand faster than the speed increases (due to the fact that centrifugal force varies as the square of velocity times the radius) is counteracted by the springs, and a smooth curve of advance is obtained as is shown by the chart at Fig. 190. The movement of the weights, as they expand, rotates the upper shaft through a maximum of 38 degrees with respect to the driving shaft, which is equivalent to 76 degrees of crank travel.

The material and workmanship entering into the construction of the Atwater Kent systems are first-class in every respect. All of the moving parts, such as the notched shaft, lifter and hammer, are accurately made and the material tempered carefully. The lifter and hammer are extremely light, minimizing the wear of the contact parts.

Vertical Mounting.

The Atwater Kent K-2 system is intended for vertical mounting only and it is advisable that it be supported by a suitable bracket or housing rigidly secured to the motor. The wiring plan is simple, and the timing is easily performed, as the position of the distributor block is quickly noted. The system permits the use of dry cells or standard storage batteries.

(To Be Continued.)

ELECTRIC OWNERS' HANDBOOK.

"Electric Automobile Charging Stations and Route Maps" is the title of a book just published by the New York Electric Vehicle Association, this being the ninth annual edition, that is especially valuable to all owners of electric carriages or freight wagons or trucks within a radius of more than 100 miles of the metropolis.

The book contains lists of all charging stations in Greater New York and within the area specified, together with the distance of each from Columbus circle, giving the maximum amperage and voltage available, the hours during which charging is done, the cost a kilowatt and the price for "boosting". It is much larger and more comprehensive than previous editions. One of the features is a map showing the location of all charging stations in Manhattan and the Bronx. Copies of the book have been sent to all operators and owners of electric passenger cars, wagons and trucks in New York and the different places listed in it.

The book is well arranged and contains information that will be very useful to all electric vehicle owners. It will be sent free at request made to the association at its office, Irving place and 15th street, or at the garage of the association, Central Park West and 62nd street, New York City.

INTERNATIONAL 1500-POUND WAGON.

The International Harvester Company is now building a 1500-pound wagon which differs somewhat from the general design of the 1000-pound machines that have been standard for several years, this having a two-cylinder, L head, water cooled motor, with bore of 4½ inches and stroke of five inches, which is rated at 20 horsepower. The wheels of this model have been reduced in size, being 38 inches with 2½-inch tires forward and three-inch tires for the rear. The wheelbase is 102 inches. The frame is pressed steel channel section, the front springs are semi-elliptic, and the front axle is an I section. The load carrying space is enlarged by moving the driver's seat forward.

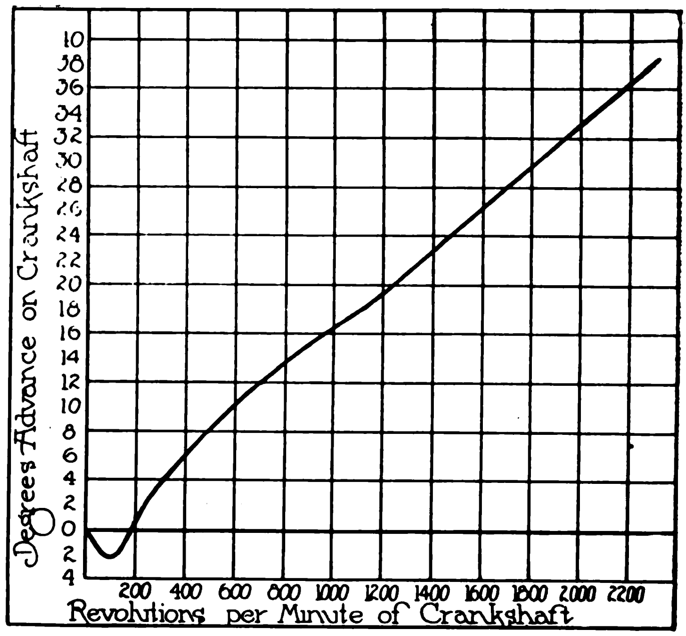

Fig. 190—Chart Illustrating the Curve of Spark Advance.

USED $500 REVENUE STAMP.

On the new million-dollar stock certificate issued in connection with the expansion of the Lyons-Atlas Company, Indianapolis, Ind., preparatory to the production of a new light weight car, a single revenue stamp of $500 denomination was used. Owing to the fact that the local revenue office had nothing larger than $2 stamps, it was necessary to get in touch with Washington before the stamp was secured.

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The Motor Truck
Devoted to Motor Driven Business Vehicles of All Classes.

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ADVERTISING RATES.
Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

BOSTON'S MOTOR TRUCK SHOW.

The annual show of motor trucks will be made this season at Boston in connection with the display of pleasure cars, this being a return to the combination exhibition that has proven to best meet the demands of the people of New England and vicinity. The Boston show is organized by dealers, who are informed as to market conditions, and who realize that a showing of wagons and trucks is absolutely imperative.

Boston's exhibition will be the only national show of the year, and it will be larger and more complete than ever before. Logically a greater numerical attendance is probable, and consequently more purchasing. The freight vehicle department will not be secondary or incidental, but to the contrary will be to many the greatest attraction. It has been planned to create business and there is no doubt of its productiveness.

THE PROSPECT FOR BUSINESS.

Conservatism is a splendid quality in any business man, but those who prefer to wait until the warring nations have declared peace, and for commerce and industry to be restored to the condition existing before the European conflict, ought to be educated to the splendid opportunities afforded by purely economic reasons. The countries of the Old World are buying food and munitions of war, and industrial requirements have been practically lost sight of. There is a prospect for greater development of the markets of the neutral nations when these have adjusted their finances. The period the war will continue is uncertain. There is no question that the United States will for a period be the market place for the world, and the continuance of that market will depend upon the preparation that is made during the war. With the restoration of peace will come large demands upon the United States. If the finances of the nation will permit much if not all of the business developed can be retained. Clear-headed business men realize this and large financial interests have made preparations to meet such conditions as can be anticipated and provided for. This means better national business and the improvement ought to be constant.

TRAINING DRIVERS.

Practically all manufacturers, and the majority of owners, prefer to have for truck drivers men who have had no pleasure car experience, and those who have trained horse drivers apparently have the best success. Manufacturers having branches or service stations, or selling agents who have well organized garages, have undertaken to train men who are to drive so that they will have reasonable knowledge of the care and attention that should be given, such training depending upon conditions.

All who have to do with the maintenance and operation of trucks are agreed that a great deal of the success depends upon the drivers, and believe that these men ought to be given every encouragement to care for the machines, rather than worked overtime and compelled to neglect their vehicles. The owners want efficiency, which can be obtained by systematizing without encroaching upon the free time of the men, and appear to forget that operating economy is absolutely dependent upon the care given the wagons and trucks. The driver problem may be difficult to adjust from the viewpoint of the owner, but with men so worked that they cannot give the trucks necessary systematic attention any neglect is frequently the fault of the man in charge of them. Training drivers may be well enough in theory, but the educated owner will take care of the driving. What is really wanted is owners' supervision and a realization by them that they are primarily responsible for the economy or extravagance of truck service.

MANY PLANTS ACTIVE.

Though there seemingly is uncertainty relative to business in many industries, a considerable number of the larger concerns building motor trucks and wagons are operating full time and, in a number of instances, with all departments working to capacity. There is a prevailing belief that with the constantly increasing cost of horse food and the fact that animal work cannot be made more efficient, the demand for power wagons of all kinds will be very much larger than in 1914.

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ELECTRIC VEHICLE PRACTISE.

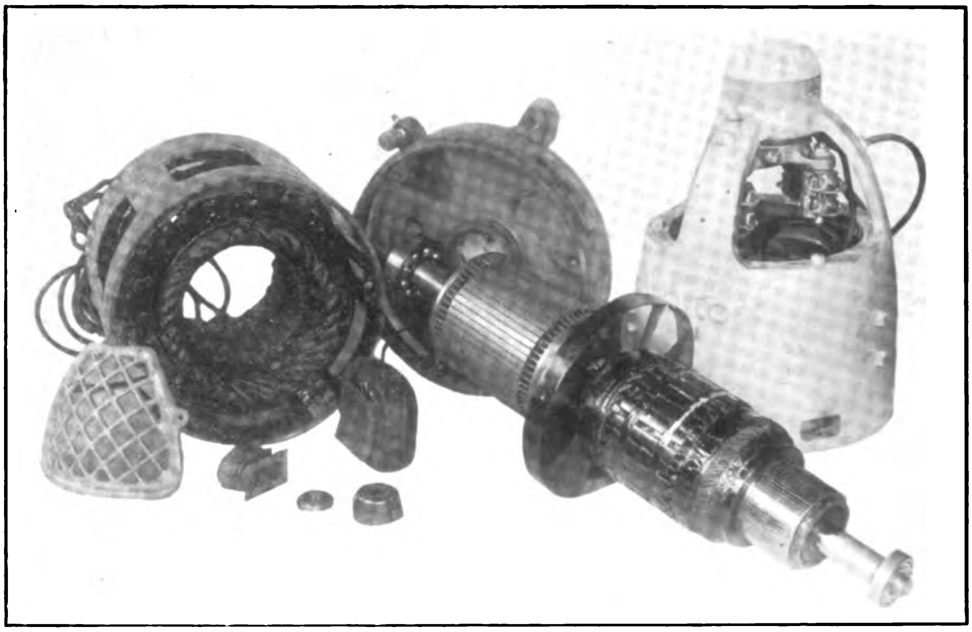
Direct Current Motor-Generators Designed for Battery Charging—Self-Excited Types and the Possibilities of Control—Interpolar Machines and Their Uses—Examples of Practical Installations of Different Capacities.

By William W. Scott.

CONSIDERATION of motor-generator sets in connection with battery charging prompts some general description of these machines relative to principles of design, construction and operation, that the reader may intelligently differentiate between the types and the uses made of each.

Motor-generators are of two types, which are general with all builders of these machines. These are the direct current generator, driven by a direct current motor, and the direct current motor driven by an alternating current motor. The set in either instance, when used for battery charging, consists of a motor and a shunt wound generator, the capacity varying according to the requirements, from the tiny little outfit intended for charging one or several cells to the machine that is productive of very large amperage.

Of course a great deal depends upon the number and size of the batteries to be charged, for these factors determine the capacity of any installation, and several units may be more economical than one in the station where a considerable number of batteries are charged. Some manufacturers produce standard sizes to meet the usual demands, and build specially when specifications differ materially from these standards. For instance, the General Electric Company's standard motor-generator sets with direct current motor and direct current generator are built in sizes from .125 to 13 kilowatts capacity, with 230 or 550-volt motors and 125-volt shunt wound generators, the speed ranging from 2250 revolutions a minute with the smallest unit to 1250 revolutions for the largest. The sets with alternating current motor and direct current generator are from .2 to 10 kilowatts capacity, with 110 or 220 single-phase motors, or 110, 220, 440 or 550-volt two or three-phase motors and 125-volt shunt wound generators. The speed of this type is uniformly 1800 revolutions a minute.



Wotton Vertical Motor-Generator Disassembled, Showing the Armature, Rotor, Field and Interpolar Coils and the Revolving Oil Pump That Lubricates the Upper Ball Bearing of the Shaft.

Practically all motor-generators have characteristics that distinguish them and adapt them for particular service, and these are used with special wiring and different devices to produce certain results. Direct current generators are classified as to the source from which the field coils receive their energizing current, they being self-excited when the field current is drawn from the armature of the machine itself, and separately excited when the field current is drawn from an outside source, such as exciter generators, storage cells or the like.

Because the self-excited generators will sometimes change their polarity when in use engineers usually endeavor to use separately excited machines when the conditions are such that the current should never be permitted to change its direction. Generators with self-excited fields are in three general classifications, the shunt wound, in which only a small part of the current delivered by the armature goes into the field (the field current being said to be shunted around the main line current); the series wound, in which all of the current delivered by the armature goes through the fields before it is sent out of the generators, and the compound, in which two coils are arranged about each pole, the one, the shunt coil, taking the shunted

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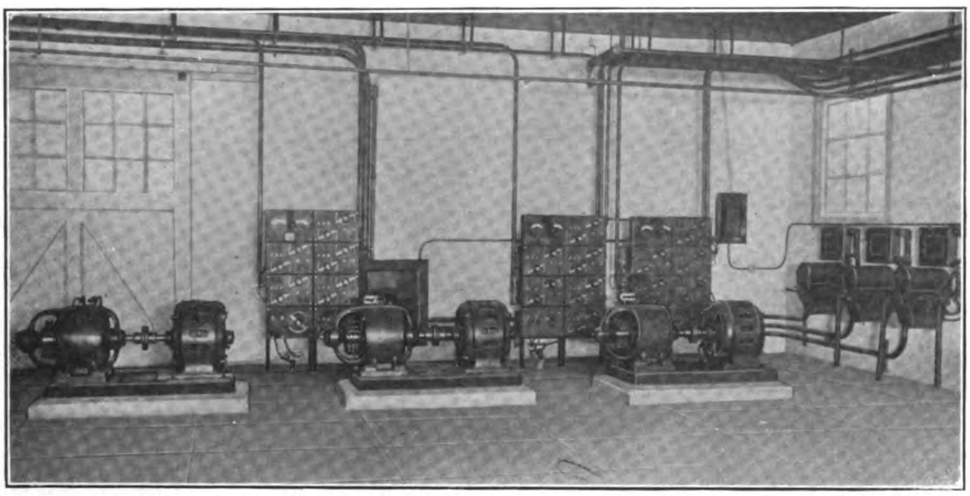
current, and the other, the series coil, taking the full or series current.

In the shunt generator, where the fields are excited by a current shunted around the main circuit, many turns of fine copper wire are used, the shunted current being kept low through using a sufficient number of ampere turns to obtain the desired excitation. When there is no current flowing through the field coils of a generator there is always some residual magnetism present in the field, and when a shunt generator is started the armature conductors are revolving in a very weak field. As the wires of the armature cut through this weak field, a slight voltage is produced across the brushes, and as the field coils are connected directly across the brushes, a small current will be sent through these windings. The strength of the magnetic field will thus be slightly increased.

With the continuance of the movement of the armature in this increased field the voltage across the brushes will be raised, a larger current will be sent through the field coils, the magnetic field is further increased, the voltage is raised and the field current amplified. This cycle is referred to as the "building up" of a field, and these cycles are continued until the fields have sufficient magnetism to produce a voltage, the value of which is governed by the speed of the armature and the resistance of the field circuit. Generally speaking, from 10 to 30 seconds is necessary for the development of this capacity, and when the voltage has become constant it can be controlled further and set to any definite value within the limits of the generator through adjustment of a resistance in series with the field. Should the voltage become too great it may be decreased by increasing the resistance, which, lowering the field current, weakens the magnetic field and reduces the voltage produced through the armature conductors. The voltage may be increased by greater speed of the armature, and reduction may be obtained by lesser speed of the armature. When the voltage across the brushes becomes constant the current can be delivered to the outside line.

Interpolar generators or motors are fitted with what are known as commutating pole or interpoles between the main poles, which do not generate power in the armature, but serve to keep the brushes from sparking when the loads are heavy. The coils on these commutating poles are always in series with the armature, so that their strength depends upon the armature current. The use of these poles with a motor will produce a very definite result—it may be reversed at full speed and not spark at the brushes. The polarity of these commutating poles can be found by determining the polarity of the main poles and the direction of the rotation of the armature. When these are known, starting from any given pole in the direction of the rotation of the armature any commutating pole will always have the same polarity as the main pole following it, if the machine is a generator. But if the machine is a motor the commutating pole will always have the same polarity as the main pole behind it.

A generator usually has the same number of sets of brushes as it has poles, not including the commutating poles. But as any generator has but two terminals that are connected to the brushes, some of the sets of brushes must be joined, so that all of the positive brushes are joined in parallel and brought by leads to the positive terminal, and all the negative brushes are similarly joined in parallel and led to the negative terminal. One fact should be borne in mind, and that is that any generator can be used as a motor if the current is sent into the armature instead of being taken from it.



Public Garage Installation of Three Motor-Generator Sets, Operated Singly or in Parallel to Charge Pleasure Cars.

The Wotton vertical motor-generator is a specially interesting type, though it is only used in small sizes. When the demands are considerable the horizontal outfit is recommended, because this will the better endure, especially when the duty is severe. The vertical installation, however, is desirable from the fact that it requires but little space, and the casing can be used as a base for the panel for the instruments, in places where the floor area is limited.

As will be noted from the accompanying illustration of a Wotton motor-generator partly disassembled, this consists of a case in three sections, these being the base, the middle and the top, the shaft carrying the rotor of the generator and the armature of the motor in combination. The rotor and the armature are built with a substantial fan between them, which affords a circulation of air through the machine and lowers the temperature while it is in operation. The base is a large plate, in the centre of which is a recess for the base bearing of the shaft, and the middle section carries the windings for the rotor. The upper section carries the field and interpolar coils for the armature.

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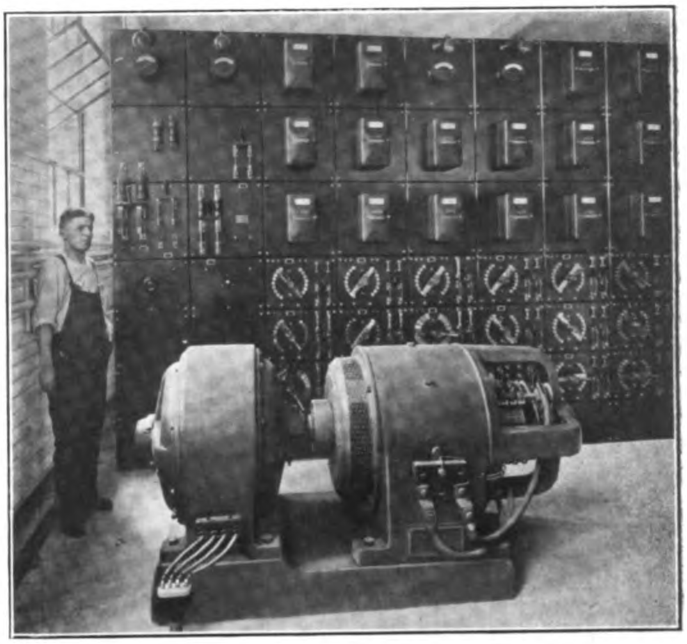
The shaft carrying the rotor and armature is mounted on large SKF annular ball bearings, which are shown at the ends of the shaft, and these are secured in the base plate or bottom and the cone at the top of upper section. The vertical construction of the machine has made possible the use of a system of automatic splash lubrication which keeps both bearings submerged in oil throughout the operation of the outfit. This is an especially noteworthy detail of construction. The revolving oil pump, which is seen in the illustration just in front of the shunt field coil (a short cone with a central opening), keeps the oil circulating continuously over the upper bearing, the pump being clamped down to the shaft just below the bearing. One of the field coils and one of the interpolar coils are shown in front of the middle section of the casing, at the left of the rotor, the interpolar coils being used for the purpose of obtaining perfect commutation and averting sparking of the commutator under the widest range of voltage. The short circuiting rings on the rotor are cast on the ends of the rotor bars, this insuring absolute rigidity. The coils are all thoroughly impregnated with Bakelite, so that there is no possibility of the coils shifting while they are in service.

This vertical motor-generator set is built in a full range of sizes and capacities for operation with alternating current 110 to 220 volts, 440 volts, or 55 volts, one, two or three-phase, 25 or 60-cycle, and for charging lead batteries from 16 to 44 cells and Edison batteries from 20 to 70 cells, at charging rates varying from 25 to,75 amperes.

The company, for heavier work, builds four-bearing horizontal motor-generator sets that are mounted on cast iron sub-bases and are connected by flexible couplings. These are, of course, adapted for differing purposes, being practical in all kinds of service. The utilization of these depends upon the conditions and the service that is necessary, but they are often used with a view of having standard equipment that will be reasonably economical in every form of operation. By that is meant that a unit is adopted that will serve several circuits—six for instance—and these are added to from time to time as needs justify. There are two practical systems, the one of which has one circuit for each vehicle to be charged, this being that most generally approved. This usually provides charging capacity not exceeding the normal rate with a separate rheostat for each car, the charging time allowed being from seven to eight hours, with longer periods for over-charging.

An example of a very practical installation is shown with equipment having one circuit for each car to be charged. In the use of this the machines, all pleasure cars, are held after washing until the peak load of the central station has passed, when one generator after another is started, according to the needs, the second, for instance, being paralleled with the first, and the third with the first and second, as the greater capacity is required. In this garage the first unit is used to capacity before the second is started, and so on, this giving a very economical service. The battery rates are maintained at 20 amperes a battery until gassing is evidenced, and then the current is reduced until gassing ceases, and charging is continued until completion. The statement is made that with this installation the charging cost is approximately $4.75 a month, which is very low. Even when the full charging capacity is needed all three sets are never in use more than two hours at a time. The statement is made that the multiplicity of the units insures greater safety and more flexibility than would be practical with other forms of equipment.

In contrast with this is also illustrated the set consisting of a 75-horsepower motor and the 400 ampere-generator, which is used with a 50-horsepower motor and 250 ampere-generator in the service station of the United Electric Light Company at Springfield, Mass. This set was built by the Electric Products Company.



The 75-Horsepower, 400-Ampere Motor-Generator Set and the Switchboard in the Garage of the United Electric Light Company, Springfield, Mass.

The equipment is shown with a portion of the switchboard. This company has 16 electric vehicles, 15 wagons and trucks and one runabout, in service, and these are all equipped with Edison batteries. The charging installation was designed to afford maximum boosting charges whenever necessary, for the vehicles are occasionally used for such periods that the normal charges may not be sufficient, and comparatively little time may be available for "boosts". That is, the large trucks may be boosted at five times the normal rates, or 450 amperes for a short time. The sets are operated at 110 volts either singly or in parallel, so that either 250, 400 or 650 amperes may be generated as desired, according to the demands.

This switchboard is provided with three 100-ampere, three 75-ampere and 10 50-ampere charging circuits. The switchboard is so constructed that addi-

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tional charging panels may be added as necessary. Because of the need of the high boosting capacity the board is equipped with two series of transfer receptacles, and by the use of "plug-in cords" the circuits may be parallelled so as to afford the necessary charging rate. By this is meant that 175 amperes may be obtained by parallelling a 100-ampere and a 75-ampere circuit. These "plug-over" units may be utilized when occasion requires for discharging one or two batteries at a time through a rheostat, or one battery may be discharged into another, so that the current may be utilized wherever practical.

The panel units of the switchboard are provided with line switches, fuses, current regulator arms, and voltmeter and ammeter receptacles, and the rheostats are constructed with numerous contacts, so that close regulation is practical. The high capacity circuits are provided with specially designed regulating arms, affording a very low voltage drop between the contact surfaces and an insurance against heating. The construction has been proven in every way satisfactory to 300 amperes current.

Two sets of meters are included, the set at the left of the illustration being an ammeter and voltmeter that indicate independently the voltage and the total current delivered by the two generators. The other set measures independently the voltage and charging rate of the individual batteries on charge. By inserting a meter plug into the proper receptacle on the charging circuit unit or the generator control unit, these indications are obtained. The operator, through this system, has at all times a definite knowledge of the condition of the battery in any machine, all the readings and the adjustments of the currents being made at the switchboard and not at the vehicles. Each charging circuit is also equipped with a watt meter, which registers the current supplied to any given battery, for each vehicle is always charged from the same circuit, and the cost of energy used by any machine is recorded for a single charge or for the entire period the vehicle has been in service.

This equipment is representative of what is to be found in the larger stations that have a considerable number of vehicles to charge, and where economy is just as necessary and logical as in the small garage. Of course in the garages of the central stations of the large cities the equipment is larger, but it is seldom more complete.

(To Be Continued.)

ENGLAND BUYS AUSTRALIAN TRUCKS.

There is probability of a considerable demand for American built motor trucks from Australia because the British government has bought every machine in that colony that can be utilized for military transportation purposes, and these have been or will be shipped to England, or direct to France. The small freight wagons were not wanted, but there is not a two or three-ton truck now in the possession of private owners, save those considered unfit for hard service, and there are few of the heavy types remaining.

Few, if any, machines are built in Australia, and to meet the demands of those whose property has been taken over by the government a considerable number of small machines, principally pleasure car chassis, are being converted into light delivery wagons, and these have been found very serviceable. There is reason to believe that there will be endeavor made to obtain light wagons in the United States, although the colony is handicapped by the necessity of credit being very generally extended. The business interests that used motor wagons and trucks for haulage have found the loss of their equipment to be a very serious matter with them, in some cases greatly diminishing their business unless replaced with lighter and less serviceable vehicles.

FORM MOTOR CAR RESERVES.

The Motor Corps Reserve, an organization of motor car owners, expert drivers and mechanics to the number of 50, has been formed at Los Angeles, Cal., which will be, it is hoped by the organizers, the beginning of a movement throughout the United States that will afford to the nation in the event of need a large force of men carefully trained in military service, as well as competent to drive or direct the work necessary in highway transportation. The command is voluntary and is composed of veterans of the Spanish war, drivers of track and racing experience, and engineers who are all skilled shots. The expectation is to interest the state military organization in the command to the extent of forming other companies and providing such equipment and facilities for drill as are essential for the efficiency of the reserve.

'BUS LINE FOR CHICAGO.

The Chicago Motor 'Bus Company, Chicago, Ill., which has obtained a franchise to operate a motor 'bus line on Chicago streets, has now applied for an exclusive franchise to prohibit other companies from entering the field. It claims that it cannot operate on a paying basis unless it has exclusive rights. This, however, has been rejected by the public utilities commission, which ruled that it did not have the jurisdiction to grant any concern a monopoly. Four other 'bus companies are now endeavoring to secure franchises.

KELLY-SPRINGFIELD WAR ORDER.

Statement is made that the Kelly-Springfield Motor Truck Company, Springfield, O., has received an order from the Canadian government for 150 3½-ton truck chassis, and that the company is to produce 30 trucks a month, following the completion of the order, until the end of the European war.

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HIGH EFFICIENCY GARAGE SWITCHBOARD.

ECONOMICAL battery charging is sought by all users of electric vehicles, and the Ward Bread Company, which is one of the largest baking firms of the country, and one of the oldest as well as a very large user of machines of this type, which has just completed a new plant at Cambridge, Mass., installed equipment in this station that is as efficient and economical as electrical engineering has created.

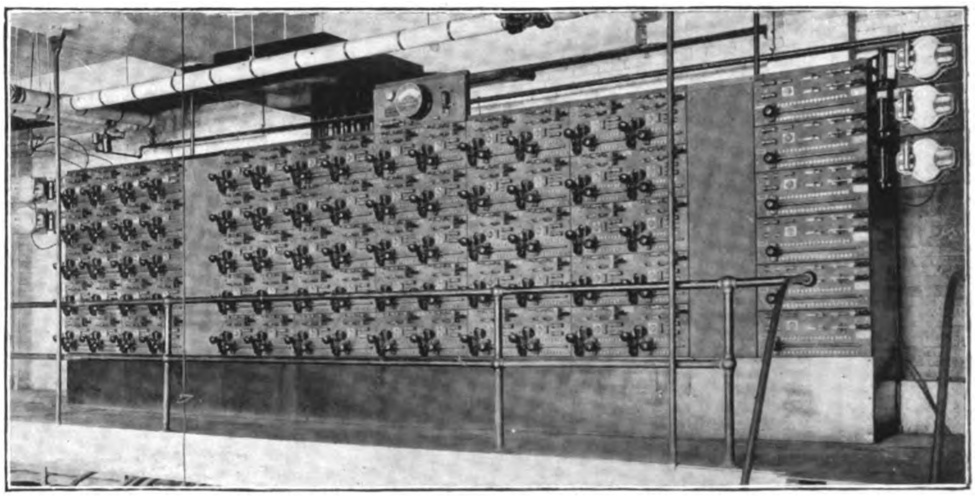
The company has baking plants in a number of the large cities, from which distribution of bread is made in considerable areas, generally by road vehicle, but sometimes by express, for the bread must be delivered quickly and received fresh. The company uses electric vehicles wherever possible, having standardized a single make and several capacities, and following this policy the machines ordered for use in Boston and its suburbs were the same as those used in New York, and, of course, the same make of battery charging equipment. The switchboard of the plant is shown in an accompanying illustration, located in a gallery in the engine room, adjacent to the garage. The board is made up of the unit section rheostats built into panels to meet the requirements for charging 70 vehicles. Each unit is intended to provide for two machines, there being seven panels of five sections each, or 35 duplex sections in all. In addition, at the extreme right of the board is a panel of six special sections for charging, discharging and forming batteries. The current is supplied from a power plant on the premises, there being a 115-230 direct current three-wire service.

Each section of the switchboard is a complete unit that carries cast grid resistance mounted on the back. On the front is a double-throw knife switch, a 15-step horizontal slider type rheostat, a reverse current circuit breaker, enclosed fuses and two two-candlepower indicating lamps, one for each of the two sets of cells charged. Each unit carries two rheostats, each of which is designed for charging a 42-cell lead-acid battery at 30 to eight amperes. The double-throw knife switch above each rheostat allows the operator to connect the batteries on charge to either side of the three-wire system, so a close balance on both sides is possible. Special clips on these switches provide for taking a reading of the charging current and the voltage across the battery simultaneously without interrupting the charging current.

In the event that the power fails or the current is reversed through the battery, the reverse current circuit breaker will disconnect each battery from the bus bars and it is so interlocked with the rheostat slider that the operator cannot begin to charge the batteries without first placing all the resistance of the rheostat in series with the battery. Each charging outlet is protected by enclosed cartridge fuses.

On swinging brackets are mounted the volt-ammeters, the two at the left and the upper two at the right being used to take readings of the charging circuits. These meters are connected in circuit only when taking a reading and this is done without opening the charging circuit. The third meter at the right is for the six rheostat charging, discharging and forming panel to which this meter is attached. Each of these units consists of a 30-step rheostat designed to charge the 42-cell batteries at 30 to eight amperes and to discharge these batteries at 30 to 15 amperes.

The small slate section mounted above panel No. 5, shown near the centre of the illustration, carries a



Cutler-Hammer Switchboard Designed for Charging 70 Electric Vehicles at the Garage of the Ward Bread Company, Cambridge, Mass.

300-ampere, zero-centre reading ammeter and an overload relay, both of which are tapped into the neutral bus bar. Should the current in the neutral rise above a predetermined value the relay causes an alarm bell to ring to notify the operator of the out-of-balance condition, and he can divide the load by the double-throw switches on the charging units.

Being made in sections this charging equipment can be added to very conveniently, which is an important advantage, minimizing expense and permitting extensions whenever desired, and without interrupting the service. This switchboard was constructed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

The Gearless Differential Company, Detroit, Mich., at its annual meeting elected George D. Bailey president, C. F. Ferguson vice president, E. O. Knight secretary-treasurer, and these officers, with H. H. Bailey, George Strub, A. MacLaren and John Schrag directors. The capital was increased from $50,000 to $75,000.

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SIX SIZES PACKARD WORM DRIVEN TRUCKS.

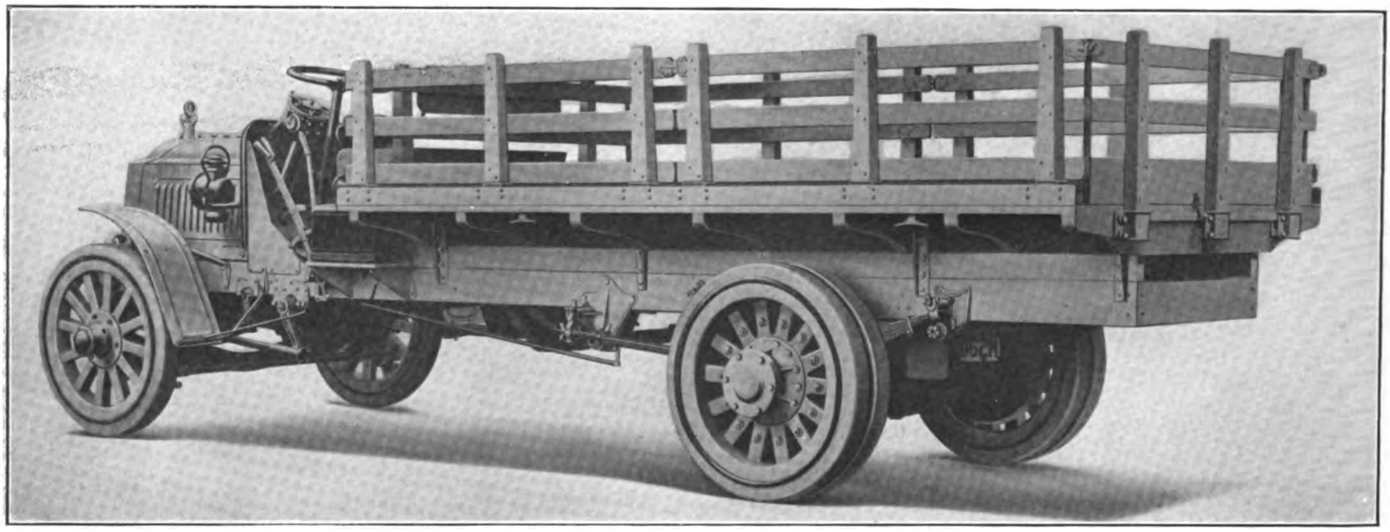
REGARDED mechanically, the new line of trucks to be produced by the Packard Motor Car Company, Detroit, Mich., in 2000, 4000, 6000, 8000, 10,000 and 12,000-pound load capacities, are especially interesting, for the inference is that these designs represent what has been demonstrated by an experience of 10 years to be best adapted for motor vehicle transportation on American roads. The machines in general have practically the same characteristics, but each size is a distinct design that differs from the others in details.

All of these vehicles are noticeable from an engineering view point because they are fitted with unit power plants, are driven by worm and gear through a full floating rear axle, and when desired can be fitted with electric engine starter and lighting system. Other details are the centralizing of the control and the placing of the steering column and the speed ratio changing and the emergency brake levers at the left side, so that the levers may be operated by the left hand of the driver.

The smallest Packard unit which has been previously produced was 4000 pounds capacity, and the announcement that the company is to build a machine to carry a 2000-pound normal load indicates that it purposes to develop the market for light vehicles, which until now it never sought to exploit. The company, with this one-ton truck, will complete a series that will practically meet every demand for highway transportation, and the types will be standardized. The purpose is, with this complete series of machines, to devote the energies of the distributing organization in every direction. Emphasis is made that each machine is designed to afford a maximum result in load haulage indicated by the rating.

In the development of the types the statement is made that these vehicles ought to be especially productive in that they can be operated with the least effort and attention from the drivers and at minimum operating expense. The chassis are of noticeably clean design and from every point of view are developed to obtain endurance and long service. The construction will be with the careful attention to the selection of materials and workmanship that has been characteristic of Packard construction. The following statement relative to the new Packard vehicles applies especially to the 4000, 6000 and 8000-pound sizes, and covers constructional features rather than details of design.

The motors are an entirely new design, being four-cylinder, water cooled, four-cycle, L head types, which are part of unit power plants consisting of engines and clutches. The cylinders are cast en bloc with a large cover plate for the water jacket, at the forward end of which the water outlet manifold is fitted. The valve pockets are at the right side. The crank case is aluminum, the upper section carrying the main bearings, and the lower section having the oil reservoir at the rear end. A forward extension of the crank case, which is removable, carries the timing gears, but the rear end of the lower section is extended to form the lower half of the bell housing that encloses the flywheel. The upper portion of the bell housing is a section that may be removed, so that the flywheel is easily accessible. It may be examined by removing an inspection plate. The clutch housing is bolted to the rear of the bell housing, practically enclosing all of the operating mechanism of the motor and clutch. In practise this construction is conventional, but the design is commendable for its simplicity and strength. The flanges of the case are heavy, affording extreme rigidity to the casing when assembled.



Three-Quarter Rear View of a Three-Ton Packard Worm Driven Truck Equipped with a Standard No. 130 Stake Body Having Removable Gates.

The pistons are constructed to obtain a practically uniform degree of pressure, they being fitted with two

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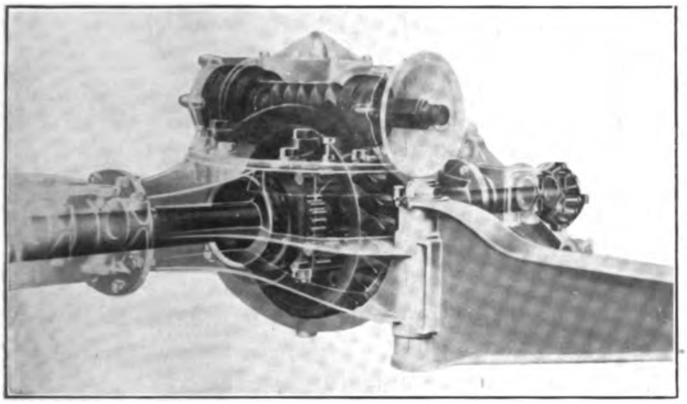


Phantom View of the Centre Section of the New Packard Rear Axle Housing, Showing the Worm, Gear and Differential.

compound and one single type ring. The upper ring is single, but the two lower grooves each carries four rings so fitted that there is no probability of gas leakage when the engine is operating. This is said to insure greater operating efficiency through the conservation of power. The crankshaft is a steel drop forging, carefully heat treated, which is mounted in four large babbitt bearings carried in bronze shells that are secured to webs in the upper section of the crank case, the centre bearings being between the first and second and the third and fourth cylinders. The camshaft is at the right side, but there are two outside shafts driven from the timing gears, that at the right driving the magneto and that at the left driving the centrifugal water pump and the automatic governor. The valve stems, springs and tappets are enclosed, these effectually protecting them against abrasion and wear.

Cooling and Lubricating Systems.

The engine is cooled by a circulation of water through the large engine jackets impelled by a gear driven centrifugal pump and a cellular radiator of the honeycomb type, and radiation is promoted by a fan mounted on an adjustable ball bearing in a bracket located forward of the No. 1 cylinder. This fan is driven by a flat belt from a pulley carried on the forward end of the magneto shaft. The water jackets and the manifolds are large, so that there is free movement of the water, insuring efficient cooling in all operating conditions.

Much attention has been given to obtain extreme simplicity and efficiency of the lubricating system. The oil is carried in a reservoir in the base of the engine case and after filtration is forced by a gear pump, that is driven from spiral gears by the camshaft, through tubing to all the motor bearings. The pistons and the cylinder walls are lubricated by overflow from the wristpin bearings and spray from the crank pin bearings, and the camshaft, cams and tappets are kept lubricated by splash and spray. The timing gears, which are helically cut and are practically noiseless, are supplied with lubricant from an overflow from an oil screen and by-pass at the forward end of the engine. The oil pressure is indicated by a gauge on the dash.

The fuel is supplied through a carburetor that is exclusively a Packard design and construction, which is stated to have met with every requirement essential to economical and satisfactory service. The instrument is a float feed type with a large mixing chamber directly above the aspirating nozzle, having automatic regulation for all motor speeds. It is protected so far as possible from accumulations of mud or dust and water, and has a hot water jacket that will promote carburetion and quick starting at low temperatures. The air intakes are provided with shut offs that will facilitate starting in cold weather.

The Automatic Motor Governor.

The automatic governor of the centrifugal type is located at the left side of the motor operating valve in the carburetor intake, and this is designed to afford an option of speed, varying with the type of chassis. The entire mechanism is enclosed and sealed, and it is operated by a lever on the central control that will afford variation within the limitation determined by the owner. The ignition is by the Packard-Bosch high-tension magneto, dual system, using one set of spark plugs, this having a battery for starting or for a spare.

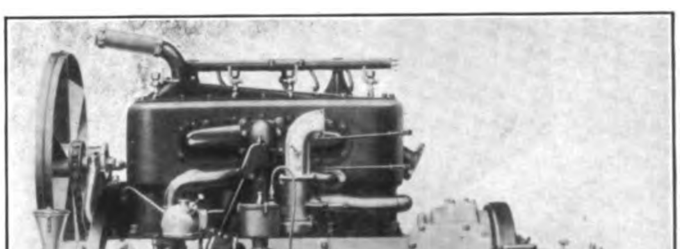
Endurance has been sought in the motor by providing large bearings and maximum size surfaces in contact, as well as abundant lubrication.

The clutch is a dry plate type that has been proven in Packard service, being very enduring and efficient, insuring easy engagement and being particularly adapted to truck service.

The Power Plant Mounting.

The power plant is mounted in the chassis frame by forward and rear cross arms, and the radiator is supported on springs at either side that protect it against stresses of chassis distortion. The construction is such that by removing the radiator, the front cross member, and breaking the different connections, the engine and clutch can be hoisted out as a unit. The completeness of the power plant is indicated by the use of a Motometer on the radiator cap, which indicates the temperature of the water in the cooling system.

The gearset is a three-speed ratio progressive construction that is mounted at three points on two pressed steel frame cross members. A power take off



Left Side of the New Packard Motor, with Which Is Included the Clutch, It Being a Block Cast L Head Type, Intended for the Three and Four-Ton Machines.

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is supplied when desired. Directly back of the gearset is the service brake, which is a large diameter drum on which is a wide contracting shoe. The power is transmitted from the gearset by a shaft with two substantially enclosed grease packed, oil tight universal joints to a worm and gear wheel incorporated in the full floating rear axle, this being a carefully developed design of great strength and endurance.

The Rear Axle Construction.

The axle housing consists of two heavy steel tubes forced by hydraulic pressure into a central section that is stoutly webbed to secure rigidity. The top of this housing is formed by a steel plate or cover, to which is bolted a carrier in which is mounted the worm, gear wheel and differential. The worm is above the gear. The worm, gear and differential, when assembled, form a unit that may be removed or installed with the cover plate. The housing base forms a reservoir for oil, which is fitted with an oil level outlet and a filler plug. Over filling this with lubricant is automatically prevented. The driving shafts are forged with integral end flanges which are cut to form the dogs that engage with the clutch plates fixed in the wheel hubs. The construction is such that the shafts, the worm, gear and differential may be removed from the axle housing, all the load being taken by the axle case.

Other Chassis Details.

The channel section rolled steel frame is mounted on semi-elliptic springs, the rear springs being shackled at both ends, so that there is no driving thrust upon them. The drive and braking stresses are taken by tubular radius rods of great strength, and by a torque arm mounted on a vertical pivot on the front of the axle housing, the forward end of which is supported by a tubular cross member. As the frame is between, instead of above the springs, the centre of gravity is lowered and greater stability of the structure is secured. The entire rear construction is very accessible.

The steering gear is a worm and sector type, the worm and sector being forged integral with their respective shafts, and the connections afford absolute safety because of their great strength and durability. The service brake on the driving shaft is sufficiently powerful in normal conditions to lock the wheels, and the emergency brake, with shoes expanding in large drums on the rear wheels, are extremely efficient. The front axle is a drop forged I section of large dimensions.

Mounted on a board on a column directly in front of the steering wheel are all the control levers, this leaving the wheel clear, while all are extremely convenient for the driver. The wheels are equipped with single solid band tires forward and dual solid band tires at the rear. The machines are built with option of 144 or 168-inch wheelbase for the two-ton, and 156 and 196-inch wheelbases for the three and four-ton trucks respectively.

NEW TAX RATE IN BAY STATE.

Beginning Jan. 1, the owners of motor wagons and trucks in Massachusetts are required to pay an increased registration tax, the basis of which is $5 for any type up to 2000 pounds capacity, and $3 for each additional 2000 pounds capacity or fraction thereof. Previous to the date stated the tax was $5 a vehicle, without regard to capacity, which was, according to the representations of the Massachusetts Highway Commission, inadequate. The present law was advocated for two years before it was enacted.

There are now more than 7500 motor vehicles owned in that state, of which about 33 per cent. are taxed the minimum rate, but the remainder have been required to pay what is regarded as extremely heavy increases, when measured by percentage. Considering these ratios of increase, that for the 4000-pound wagon is 60 per cent., for the 6000-pound truck 120 per cent., for the 7000-pound truck 180 per cent., for the 8000-pound truck 180 per cent., for the 10,000-pound truck 240 per cent., for the 12,000-pound truck 300 per cent., and for the 14,000-pound truck 360 per cent.

GOODYEAR HAS A GOOD YEAR.

The reports presented at the annual meeting of the Goodyear Tire and Rubber Company, Akron, O., held recently, show that 1914 was the most successful in the history of the company. The net earnings for the fiscal year, ending Oct. 31, 1914, were $3,301,000, equal to 36 per cent. on the common stock. The balance sheet shows current assets of $11,039,000, and current liabilities of $668,000, although notes were paid during the year to the amount of $3,653,000. All assets are actual values, as good will, patents, trade marks, etc., are always carried at $1 by the Goodyear Company. The cash on hand is nearly $3,000,000, more than double that of 1913. The board of directors and the officers of the company were re-elected.

ELECTRICS FOR PARCEL POST.

Three electric cars, made by the Connersville, Ind., Buggy Company, have been placed in service at the Indianapolis, Ind., postoffice, by way of demonstration of their value and economy. The service is given for this purpose by the Electric Vehicle Company, and it is planned to increase the equipment three cars at a time until 12 are at work.

MONEY FOR COLORADO ROADS.

Colorado has $750,000 annually for good roads, of which $150,000 is derived from motor license fees, and the balance raised by a special tax of one-half mill for the highway fund.

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LARGE ECONOMY OF 10-TON TRAILERS.

OPERATION of highway transportation equipment depends primarily upon the judgment of the owner or his representative, and a knowledge of the possibilities with reference to conditions in which a work is done. Progressive men deal with situations as they find them, sometimes with regard merely for the present, and again with provision for the future so far as it may be forecasted.

Heavy haulage in the sense of large loads is always the most economical and logically the most profitable, but where the freights are of considerable size much depends upon the units if these must be handled and arranged. In any event the time required for loading and unloading is necessarily idle so far as actual transportation is concerned, and if this unproductive time can be minimized the greater the ratio of productive work, provided conditions will allow the operation of the machine.

E. W. Woolman, who operates the Woolman Dairies in Philadelphia, Penn., has in his service a Mack tractor, which is rated at five tons, which hauls a trailer with capacity of 10 tons, that, according to Mr. Woolman, has proven to be a highly efficient and economical machine. The tractor is a standard construction with wheelbase of 133 inches, and it is fitted with a cab and windshield so that the driver may be amply protected in storms or cold weather. On the rear deck of this tractor is the Mack universal coupling or fifth wheel, which is an adaptation of the fifth wheel or turntable as utilized by horse vehicle builders.

Special Type of Enclosed Body.

The centre of the fifth wheel is directly above the rear axle of the tractor, and on this is carried the upper section of the turntable, which is attached to the body of the trailer. The trailer body is constructed of wood, the interior dimensions being 204 inches length, 81 inches width, 72 inches height at the forward end and 75½ inches height at the rear. In the floor, extending the full length of the body is a steel plate 16 inches width, the surface of which is even with the deck. On either side is a rail or cleat which supports a removable deck of wood. The deck is composed of boards 12 inches width, and when these are in place there is a lower compartment with 28½ inches clearance under it.

The body is mounted on heavy semi-elliptic springs, which is carried on a large Timken axle and 54-inch diameter wooden wheels with steel tires 10 inches width. The construction is seemingly very large, but the loads carried will average in excess of 10 tons, and the haulage is very much of the time over the streets of the city. A full load is 168 cans of milk, each weighing about 125 pounds, 78 of which are stored in the lower compartment and 90 in the upper, the total weight being approximately 21,000 pounds.

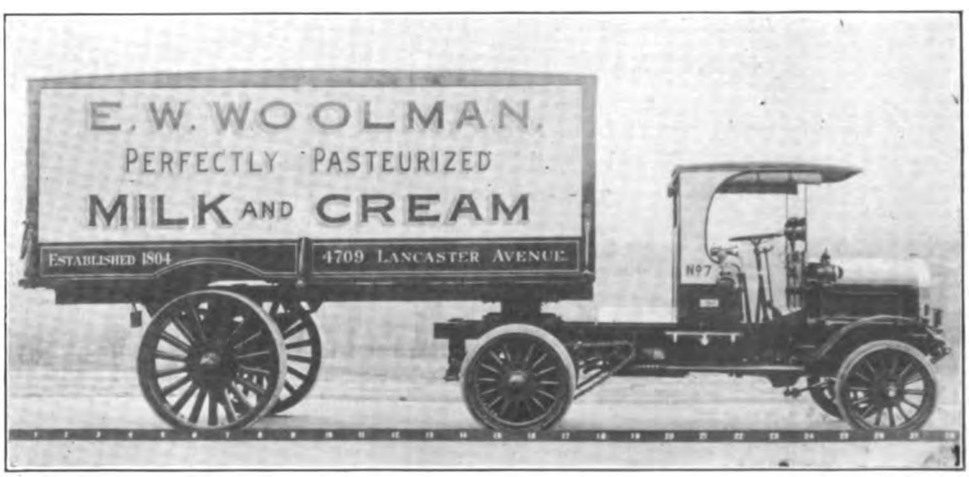
Body Designed for Quick Loading.

The arrangement of the body is for comparatively quick loading, for two men can in 20 mniutes take on from a railroad freight house platform a full freight of cans. The trailer is backed to the platform and two rows of cans placed across the forward end of the lower compartment. Then two sections of the removable upper deck are laid and two rows of cans placed on that. This is repeated until the full load is taken on, one man handling the cans in the body and the other taking them from the loading platform and sliding them forward on the steel plate in the floor of the trailer. The cans could not be handled in this manner on an ordinary wooden deck. The load is removed by reversing the loading process.

The Woolson dairies are at 4709 Lancaster avenue, and the milk is hauled to them from the railroad terminals and to the distributing station at Darby, as well as incidental work, such as transporting supplies and empty containers. Previous to the purchase of the tractor and trailer the work was done by two triple teams of horses, two extra animals being required to keep the haulage efficiency at the standard desired.

A Typical Day's Haulage.

A typical day's work is given to show that the tractor and trailer, even with the 10-ton capacity, is worked generally 15 hours each day, and two drivers are kept on the work, each working alone a part of the time. Starting at 7:30 in the morning with two drivers the tractor is driven from the dairies to the Pennsylvania railroad milk depot at 31st and Chestnut streets and hauls two full loads of 168 cans each, the round trip being six miles. A third trip is made to the Baltimore & Ohio railroad milk depot at 25th and Spruce streets for a load of approximately 150 cans,



Mack Tractor and Specially Designed 10-Ton Trailer Used for the Haulage of Dairy Products in Philadelphia, Penn.

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the round trip being about $6\frac{1}{2}$ miles. The men then go to lunch, the tractor having about $18\frac{1}{2}$ miles and three loads that will weigh 30 tons to its credit.

In the afternoon one driver works. Bottles are hauled from the freight station at 52nd street and Lancaster avenue to the dairies, the number of trips depending on the number of carloads of milk that are brought in. When not thus engaged bottles are hauled to and from the Philadelphia Bottle Exchange at 11th and Poplar streets, this trip being practically 10 miles. The tractor is returned to the dairies at 5 o'clock, where it is loaded with milk and cream in cans and in quart, pint and half-pint bottles in cases, which load is hauled to a distributing station at Darby, this being a 12-mile trip, the return being made with a load of empty cans and bottles. The driver who worked during the afternoon is relieved at 6 o'clock by the man who worked during the morning. After the freight of empties from Darby is unloaded a load of empty cans is taken on and this is hauled to the Pennsyivania railroad milk depot at 31st and Chestnut streets, where this is unloaded and a freight of full cans is brought back to the dairies. This work is usually completed about 10:30 and the tractor is sent to the garage for the night. The drivers alternate their working hours each week.

BIG MOTOR STREET SPRINKLER.

The Kissel Motor Car Company, Hartford, Wis., has supplied to the highway department of Pueblo, Col., what is probably the largest motor street sprinkler in service. This consists of a six-ton KisselKar chassis on which is mounted a 1500-gallon tank, with water pump and headers for sprinkling, which will sprinkle a 60-foot street at a single operation, and which can be utilized for flushing the paving. The machine weighs, when loaded, approximately 12 tons, and if expectations are realized in service it will replace about 14 horse drawn tank wagons. When used for flushing eight horsepower is required to maintain 50 pounds pressure in the tank. In a trial the machine has been equal to the estimates.

BERLIN TRADE REPORT.

A weekly trade report from Berlin, Germany, during the present crisis, is being published by the American Association of Commerce and Trade, Berlin. The motive is, it is said, to foster the commercial relations between the United States and Germany. It is the belief of the association that after peace has been declared, the American exporter will find a more ready market and fertile field for his goods in Germany than ever before.

These reports will be mailed free of charge to those desiring to receive them. The address of the association is the Equitable building, Friedrichstrasse 59-60, Berlin, Germany.

AMERICAN DROP FORGE ASSOCIATION.

Representatives of many of the larger drop forge manufacturing concerns in Michigan, Ohio, Indiana, Virginia and Canada, recently met at Detroit, Mich., and formed a temporary organization under the name of the American Drop Forge Association. Temporary officers were elected as follows: President, R. S. Ellis, superintendent of the Detroit Forging Company; vice president, George Desautels, manufacturing manager, Anderson Forge and Machine Company; secretary, A. E. Dibble, department manager, Frost Gear and Machine Company; treasurer, E. B. Horne, forge and foundry superintendent, Packard Motor Car Company.

DEMAND FOR PRESSED-ON TIRES.

According to C. V. Martin, manager of the motor truck tire department of the Goodyear Tire & Rubber Company, there is an increasing demand for truck tires of the pressed-on type, which are designated as "S. V." by the company, wherever there are facilities for handling them, and that the company is now preparing to equip many of its branches for removing and installing these tires on wheels. The statement is made that from the tests and experiments this is the best truck tire the company has as yet produced.

PEERLESS SELLS 250 TRUCKS.

An order for 250 trucks has been received from London, England, by the Peerless Motor Car Company, Cleveland, O. This order came from Gaston, Williams & Wigmore, and calls principally for four-ton models and will be equipped with the conventional army bodies having semi-circular tops covered with canvas. In addition to this initial order there is said to be another for 50 trucks a week after the first order has been supplied. This will be a steady order until notification terminating such has been given.

WISCONSIN LAWS CONFLICT.

The Milwaukee, Wis., ordinance prohibitng glaring headlights has been held invalid owing to the fact that it conflicts with the state law providing for bright lights on motor vehicles and specifically stating that no vehicle complying with the regulation shall be denied the use of any public highway or parkway in the state.

The Yakima Avenue Auto and Wagon Works has been established at Tacoma, Wash., to build motor truck wheels, bodies and wooden equipment for power wagons.

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HINTS FOR PROPER MAINTENANCE.

THE importance of a gauge for indicating the supply of lubricant in the crank case of a motor is recognized by the manufacturer of the modern car,

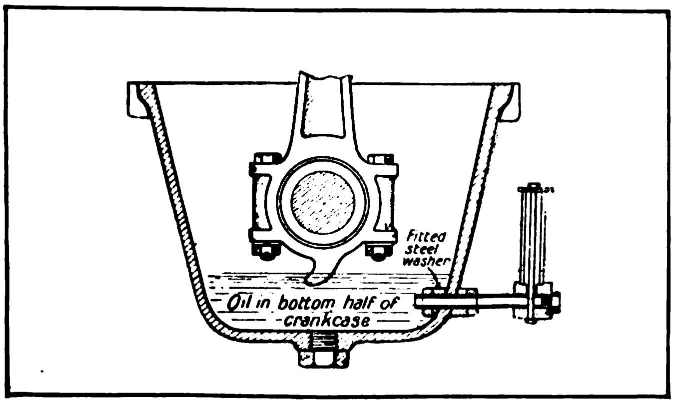

Fig. 1—Showing Construction Details of Oil Gauge Fitted to an Old Motor.

but many of the converted pleasure motor vehicles are not thus equipped. Generally lubrication is by the plain splash system, and the supply is renewed when it is deemed necessary by the operator of the machine. There is more or less guess work with this method, and frequently the bearings are starved of lubricant.

A suggestion for fitting an old motor with a gauge appeared in a recent issue of the Commercial Motor, and the method is shown at Fig. 1. The material is not expensive and the work can be performed by one handy with tools, or the parts could be made at a slight cost.

The first step is to ascertain what should be the proper location of the gauge in the crank case, and if the motor is being overhauled it will be a simple matter to displace a cylinder and, with the connecting rod at lower dead centre, measure for the opening as well as for the proper oil level.

The crank case is then prick punched, and a hole drilled to take a piece of ⅜-inch gas pipe. In the drawing it will be noted that the pipe is retained by two tapered washers, but the wall of the crank case could be tapped and the end of the gas pipe threaded. Tapered washers and lock nuts would insure rigidity of the pipe.

The most difficult part of the work in building the gauge is the making of the block which forms a standard for the gauge proper. This block is made by taking a piece of one-inch square steel, and drilling a hole to take the pipe. It will be noted that this hole is carried through the block and the free end is closed by means of a plug.

A 7/16-inch hole is drilled in top of block and opening recessed slightly, ⅝-inch in diameter, for the glass tube to fit into. Two washers are cut, one for the top and the other for the bottom, the tube resting on these. By utilizing a 3/16-inch threaded bolt and passing it through the tube and block, the glass tube is held in place, as well as made leak proof. The correct height for the lubricant is marked on the glass tube.

ADJUSTING STEERING GEAR.

After considerable service the steering gear and its linkage will require attention. Much of the wear is generally due to a lack of proper lubrication, especially in the linkage of old machines which is not provided with grease cups or similar lubricating devices.

There are two movements of the steering wheel which occasion wear, the rotating, as in steering the car, and the thrust or end play. With the average type of steering gear, means are provided for eliminating lost motion, but the work of adjusting the components must be carefully performed else the parts will bind. In testing for lost motion one should note carefully whether or not the lost motion is due to play in the linkage.

The type of steering gear, such as shown at Fig. 2, provides compensation for end thrust and lost motion. To adjust the gear, both front wheels should be jacked clear of the floor and, by having some one hold a wheel firmly, it can be ascertained how much of the lost motion is due to the gear and how much to its linkage.

If too much play exists, loosen the clamping bolts A and B, then turn the slotted adjusting nut to the right until the lost motion is eliminated. Next rotate the steering wheel to the maximum of its movement and adjust the worm gear by turning the eccentric bushing C. This adjustment should be made with the wheel turned either to the extreme right or left, because the wear occurs in the centre. If, after several adjustments have been made, it be found that no more take up is possible, a new surface of the worm will have to be utilized.

Displace the clamping bolt C and rotate the wheel

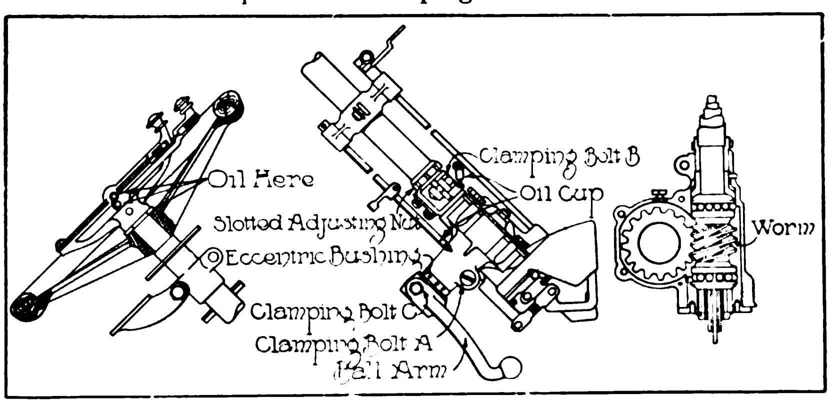

Fig. 2—Components Utilized in Eliminating Lost Motion from Steering Gear.

1½ times. This will bring one of the new surfaces in mesh with the worm. There are four surfaces to be employed. After making the adjustment of the other

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components, replace the ball arm and make sure that all parts, such as the clamping bolts, are locked securely.

Always renew the supply of grease when overhauling the steering gear.

Lost motion in the linkage will require varying treatment, according to the design. Generally the drag link is adjustable, but the tie rod yokes may require new bushings and new bolts. It is generally cheaper to fit new bushings and bolts than to attempt to turn down the old bolts and make bushings to fit them.

KOEHLER TRUCK AGENCIES.

Agencies for the sale of Koehler power wagons have been established as follows: Adalian Brothers, Boston, Mass.; G. & A. Bell, Paterson, N. J.; City Garage, Norfolk, Va.; Coffey & Irwin Improvement Company, Greenfield, Ia.; Crocker Garage, Falmouth, Mass.; Holmes Adkins Company, South Omaha, Neb.; William Iliff, Newton, N. J.; W. L. Krider, Meadville, Penn.; J. C. Lamb Auto Repair Company, Savannah, Ga.; Alsop Motor Company, Richmond, Va.; W. E. Cookerly, Macon, Ga.; Franklin Hardware Company, Franklin, Ky.; Greensboro Motor Car Company, Greensboro, N. H.; Lewis & Drye, Lebanon, Ky.; Bartley Mallow, Chillicothe, O.; Solon A. Stein, Reading, Penn.; L. M. Vordemberge Motor Company, Baltimore, Md.; C. U. Williams Son & Co., Bloomington, Ill.; Weld & Beck, Southbridge, Mass.; Speth Garage and Sales Company, Augusta, Ga., and Lininger's Garage, Greencastle, Penn.

WILL NOT AFFILIATE.

After long discussion at a recent meeting of the Automobile Trade Association, Washington, D. C., it was decided to lay on the table the matter of affiliation with the Retail Merchants' Association. The election of officers resulted as follows: President, Joseph M. Stoddard; vice president, S. A. Luttrell; secretary, Robert H. Martin; treasurer, Colonel W. C. Long; directors, W. S. Keeler, H. B. Leary, Jr., and Claude E. Miller. Others present were William Ullman, Howard Fisk, Harry Ward, Jerome Fancuilli, R. H. Harper, P. I. Harper, R. C. Smith, Leroy Mark, Irvin T. Donohoe, J. J. Barnhart, H. A. Jenks and J. J. Haas.

TRUCKS AT THE DETROIT SHOW.

At the Detroit automobile show there was a very good display of wagons and trucks, there being 34 complete vehicles and 14 chassis shown. Of these 34 complete machines 30 were gasoline and four were electrics, and of the 14 chassis one was electric. The display included one electric taxicab.

OVERLOADING TRUCKS CONDEMNED.

The commercial vehicle committee of the N. A. C. C. is making a consistent effort to discourage the overloading of commercial vehicles, and has asked the assistance and co-operation of the manufacturers of springs, who are usually called upon to supply rear suspension members of greater strength than the standard capacity, in order to accommodate the greater weight. It is pointed out that the strength and capacity of all parts of a properly designed truck are worked out on the basis of the maximum load, and that a change in the springs which will permit this to be increased will only throw strains on all other parts, which they were not designed to bear, and for which they are not guaranteed. The suggestion is made that the spring manufacturer decline to fill such orders without the approval of the maker of the vehicle, and this has already been agreed to by a number of these concerns. The annual banquet of the N. A. C. C. will be held at the Waldorf-Astoria on Tuesday, Jan. 5, which is during show week.

TWO LARGER DENBY TRUCKS.

The Denby Motor Truck Company, Detroit, Mich., which has built 1500 and 2000-pound wagons since its organization, has begun the production of 3000 and 4000-pound machines. The trucks are to the same general design, using a Continental motor, 3¾ inches bore and five inches stroke, of the L head type, with the cylinders cast en bloc. The ignition is an Eisemann magneto and Westinghouse engine starters and Kemco lighting systems are regular equipment. They are built with 144 or 160-inch wheelbase as desired, with left side drive and centre control levers. The size of the tires is noticeable, the 3000-pound machine having 34 by 3½-inch forward and 36 by six-inch rear shoes, and the 4000-pound truck has 36 by four-inch tires forward and 36 by six-inch single or 3½-inch dual rear.

UTILITY STEEL TRACTOR COMPANY.

With capital of $25,000, the Utility Steel Tractor Company has been organized at Antigo, Wis., with D. C. Stewart president, N. C. Woodin vice president and F. A. Hecker secretary-treasurer. The company will build a four-wheel driven tractor from designs by Mr. Woodin, who was chief engineer for the International Hoist Company. The company is considering several probable sites in Wisconsin and Illinois for a factory, which will be erected the coming spring.

The Stewart Motor Corporation, Buffalo, N. Y., which since its organization has manufactured motor wagons exclusively, has begun the building of passenger cars, and displayed its first model, a six-cylinder touring car, at the Buffalo show.

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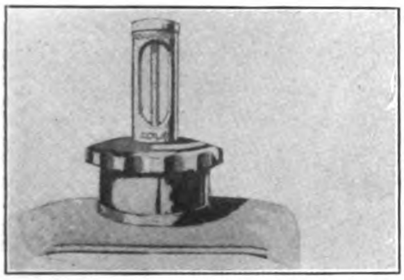
NEW COMMERCIAL CAR ACCESSORIES.

THE "MOTOR EYE".

W. Lewis Mack, general distributor, 20 West Jackson boulevard, Chicago, Ill., is marketing a practical and useful device termed the "Motor Eye". As may be noted by the accompanying illustration it is mounted on the radiator cap by drilling a 7/16-inch hole in the cap and passing the standard through the opening. The standard has a threaded stem for taking a lock nut, which is screwed up to secure the "Motor Eye" in position.



The device serves a number of useful purposes. It warns the driver when the temperature of the cooling fluid rises above normal, as well as indicates low temperatures. Any failure of those components of the motor which would cause the overheating of the power plant is denoted by the "Motor Eye".

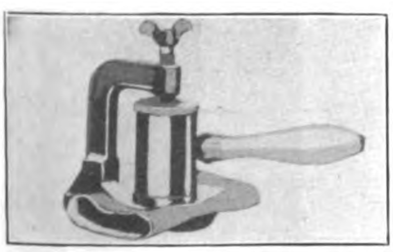
The registration of the temperature is obtained by a mercury charged, metallic, thermo conductor rod in direct contact with the water as it leaves the motor and passes into the radiator. The device is calibrated, and readings are taken as easily in the night as in the day, as the height of the fluid is easily noted against the light background afforded by the rays of the headlights. The "Motor Eye" is inexpensive and comes in two finishes, black and nickel.

QUICK ACTION VULCANIZER.

The production of vulcanizing equipments, especially of the portable type, has been responsible for a large number of drivers undertaking repairs to tires and inner tubes. The types designed for the novice are easily and successfully operated and, as a rule, do not require a knowledge of the principles of vulcanizing to accomplish good work.

Henry T. Adams & Co., Chicago, Ill., has brought out a new type of vulcanizer which presents interesting features. It is of the electric form, and it is stated that it will operate efficiently from any 110-volt lighting circuit, or from the lamp socket of a motor vehicle equipped with electric lighting. It is also stated that the current generated by the Ford flywheel magneto may be successfully employed to operate the vulcanizer.

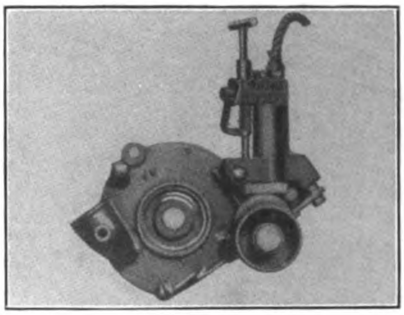
The Quick Action vulcanizer, as it is termed, permits of making repairs on the road, as well as in the garage, and is held to be very efficient for vulcanizing casings. It is stated that a repair can be made in 20 minutes. The vulcanizer is fitted with an automatic heat regulator, preventing burning, and it is claimed that a repair can be made to an extra casing or tube when the car is in motion, as the device draws but little current. It is moderately priced.



UNION AIR PUMP.

The Pittsburg Auto Equipment Company, Pittsburg, Penn., is manufacturing the Union motor driven air pump for the model T Ford automobile, which should appeal to the operators of these cars desiring a power tire pump. The device is permanently attached by removing two bolts and the lower fan pulley, and substituting the bolts and pulley supplied with the Union equipment. The maker states that there is no drilling or machining to be performed and that the parts are accurately made.

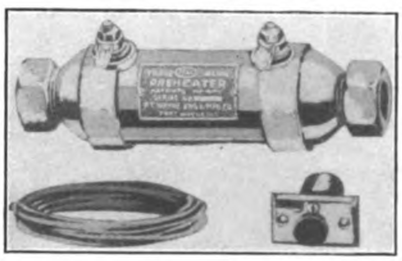
The pump is brought into operation only when the guide rod is depressed, and it is stated that it will pump up any Ford tire to a pressure of 60 pounds in 75 seconds. To throw the pump out of operation the guide rod is lifted and secured in position by a keeper. With each Union pump are supplied 11 feet of the best high pressure air hose, nipple and valve connections. The material and workmanship are first-class in every respect, and the price is moderate.



PAUL CARBURETOR HEATER.

The Fort Wayne Engineering & Manufacturing Company, Fort Wayne, Ind., is marketing the Paul carburetor air preheater, a device for making easy the starting of a cold motor in low temperatures. Use is made of the heat of electricity.

The preheater is incorporated in the tubing or coil conveying the heated air from the exhaust manifold to the air intake of the carburetor. By pressing a button the current heats the device, and when the motor is cranked warm air is drawn into the carburetor, assisting in the vaporization of the cold fuel. The complete equipment includes the heater, 15 feet of wire, a cowl switch and instructions. The preheater will operate on any six-volt current.

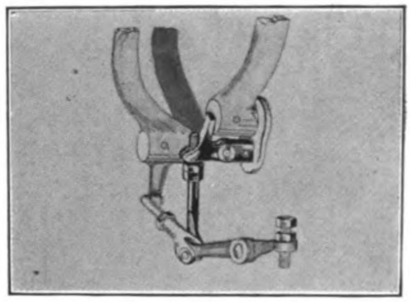


RAISEWELL JACK.

The Sipp Machine Company, Paterson, N. J., is introducing the Raisewell jack, which is stated to be a radical departure from conventional practise in that a jointed handle 2½ feet long is employed for operating it.

FORD CLUTCH THROW-OUT.

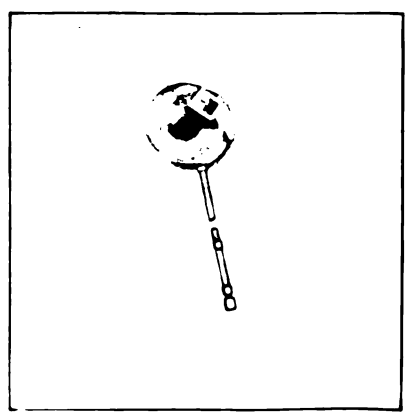
The Perkins-Campbell Company, Cincinnati, O., maker of Ford specialties, is marketing the Ford clutch throw-out, a device with which the driver can disengage the clutch by operating the brake pedal. This reduces the effort by 50 per cent., as it is not necessary to operate both the clutch and brake pedals. The clutch throw-out is also of service when utilizing the reverse pedal and will be appreciated by beginners, who generally stall the motor. It affords perfect control when operating the car either forward or backward. The device can be attached in a few minutes without alteration.



AUTOMATIC TIRE INFLATOR.

The D. L. Davis Manufacturing Company, Marquette building, Chicago, Ill., is marketing the automatic tire inflator, which is a novel mechanical construction that maintains the tires of the motor vehicle in a fully inflated condition; that is, air is pumped to the shoes when the car is being operated. The air is supplied by a pump of the diaphragm type, and there is a distributor on the dash board of the machine.

The air is pumped through rubber tubes to a rotary joint placed in each wheel. This joint consists of two circular discs, which revolve upon one another, one disc being fixed in the hub of the wheel, revolving with it, while the other is attached to the axle, and is stationary. These discs are connected by a deep groove in the revolving disc, into which fits a projecting ring or flange on the other disc, which carries a U shaped gasket of such form that, when air is pumped into the groove the pressure expands the gasket, so that the edges grip the walls of the groove. This provides an air chamber in the hub of the wheel, and the air is carried from this compartment direct to the tire. An air tube leads from this chamber to the valve stem, as shown in the accompanying illustration. An adjustable sliding sheath connection is provided, making it possible to attach a conventional hose line. The device is reasonable in price.



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POLO TIRE ALARM.

W. Lewis Mack, general distributor, 20 West Jackson boulevard, Chicago, Ill., is marketing an improved model of the Polo tire alarm. This device is for service on pneumatic tires, is attached to the dust cap threads of the valve stem, replacing this and the valve cap. The Polo tire is a signal and gives warning to the operator of a motor vehicle when the pressure falls below that which should be maintained. The device has a wide range of adjustment, and can be set as desired. It also eliminates the use of a pressure gauge. The alarm is so constructed that it can be entirely shut off without removal if its service as a warning is not required. The Polo tire alarm comes four to the set and is inexpensive.

New Polo Tire Alarm.

The "M-E" tire tool is another practical device marketed by W. Lewis Mack. It is very compact, and consists of a pair of jaws having prongs which open cuts in a tire sufficiently to permit cleaning and repairing. The tool is operated by a trigger and ratchet device. Details and prices will be supplied upon request.

WILLYS RETIRES FROM TRUCK INDUSTRY.

The retirement of John N. Willys from the motor truck industry took place Jan. 15, when the Willys-Overland Company disposed of its interests in the Gramm Motor Truck Company of Lima, O., to the Geiger-Jones Company, Canton, O., and by the conditions of the transfer the Geiger-Jones Company will manufacture large and small trucks and will control the sales organization of the Garford trucks and Willys Utility wagons, before then built at Elyria, O. With control of the common stock and their interest in the preferred stock of the Gramm Company, the Geiger-Jones Company will direct the production and sales, continuing the plant at Lima, O., and the service stations in New York, Boston, Brooklyn, Newark and Philadelphia, and maintaining their relations with Overland dealers and distributors throughout the United States and foreign countries, with the purpose of expanding the business as rapidly as conditions justify. The reason stated by Mr. Willys for disposing of the truck interests are that he considers it a business separate from manufacturing automobiles in quantities, and the growth of the Overland Company has necessitated concentration of its organization at the main plant at Toledo.

WILSON WORM DRIVEN TRUCK.

The J. C. Wilson Company, Detroit, Mich., which recently began building a 3000-pound chain driven truck, has produced a worm driven machine of the same capacity which was seen for the first time at the Detroit show. The tractive effort is through the forward ends of the rear springs, there being no radius rods. In other details the design is similar to the chain driven type.

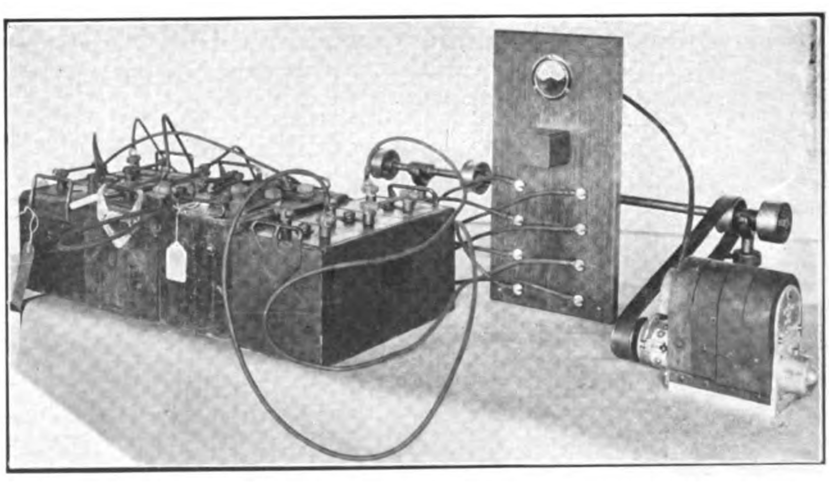
NEW 'BUS SERVICE IN NEW YORK.

Making four trips a day, a new 'bus line operating between Sherburne and Oxford, N. Y., is meeting with favor and, should the state highway between Utica and Binghamton be promptly completed, it is probable that the proposed trolley will not be built, and that the 'bus service will be continued in its place.

ESTERLINE CHARGING OUTFIT.

The Esterline Company, Indianapolis, Ind., has brought out a low-priced battery charging outfit for service where a large number of cells is not to be charged daily. The equipment comprises a dynamo suitable for charging both six and 12-volt batteries, a switchboard with a zero centre, a nickel plated ammeter, and an automatic switch for connecting the batteries to the dynamo or disconnecting them in the event the generator should cease operating. Provision is also made on the board for the charging of four batteries at one time.

The switchboard is 10 by 20 inches, and is designed for mounting on or near the wall. All of the permanent connections are made in the rear of the board and the battery connections on the front. The equipment in service is shown in an accompanying illustration and, as may be noted, the dynamo is fitted with a pulley and driven by belt from an electric motor. The dynamos are made in two capacities, rated at 12 and 18 amperes respectively.



The Esterline Charging Equipment Having Automatic Switch.

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NEW MACHINERY, TOOLS AND EQUIPMENT.

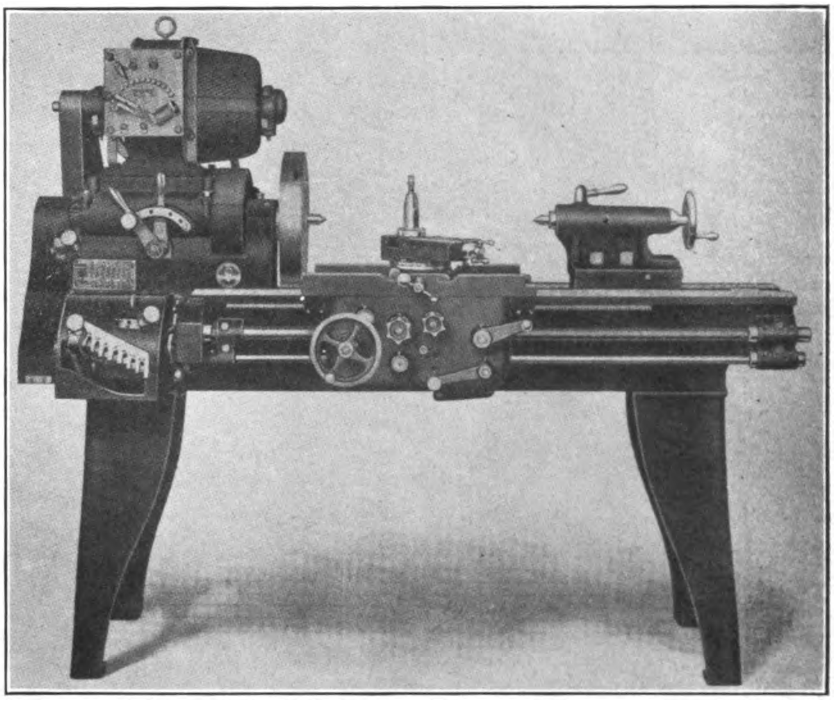
TO MEET the demand for the individual motor driven and single-pulley driven lathe, the Monarch Machine Company, Sidney, O., has developed the Monarch geared headstock, which method of drive can be applied to all sizes of lathes produced by this concern.

The headstock provides eight mechanical changes of spindle speeds covering a wide range, any one of which is practically instantly obtained by the two levers on the front of the headstock. With the driving shaft at the recommended speed of 300 revolutions a minute the spindle speeds afforded are as follows: 25, 40, 58, 83, 116, 182, 262, 375. This, the maker points out, provides a sufficiently wide range of spindle speeds for all practical purposes. A wider range of speeds can be furnished, if desired, by using a two-speed countershaft with the single-pulley drive, and a variable speed or multi-speed motor with the motor driven lathe.

The headstock is of the solid, full webbed type, carefully aligned with the bed, and its rigidity and close adjustment prevent chattering on heavy cuts. The spindle is large, is made of 50-point carbon crucible steel, and is accurately ground to size. Phosphor bronze is employed for the spindle bearings.

The bed is wide and deep with heavy walls and large box girders afford strength. The back gears are locked in and out of position by a spring plunger, and the double back gears are of the positive geared type. The tailstock is substantial, has two clamp bolts and is so shaped that the compound rest can set at right angles when turning work of small diameters. All joints are carefully hand scraped, insuring accuracy and alignment. The compound rest is gibbed throughout, is very wide and has large wearing surfaces. The dial, the swivel and the cross feed dial are accurately graduated. The tool post is of steel, milled from the bar. The steel rack is in one section and is cut to templets to insure accuracy. The carriage and apron are held to be exceptionally large and heavy for a lathe of this size. The carriage has a 23-inch bearing. The cross bridge is six inches wide and is heavily reinforced. All small gears in the apron are of steel, and all studs are provided with an oil device. The lathe has a feed reverse, and an interlocking device prevents the feed rod and lead screw from becoming engaged at the same time. The rack pinion disengages when screw cutting.

The mechanical principles used in the Monarch geared headstock are the same as utilized in the gearset of the motor vehicle, having sliding gears and positive clutches. Twelve gears comprise the gearing, eight of which are constantly in mesh and four slide in and out, these being of steel. All gears are cut eight pitch and are 1¼-inch face. The two shafts are 1¾ inches in diameter and operate in phosphor bronze bushings. Details and prices of the lathe, as well as the other products of the company, will be supplied upon request.



The Monarch Individual Motor Driven Lathe, Operated by a Two-Horsepower Constant Speed Motor—Drive Is by Silent Chain.

HAUCK KEROSENE TORCH.

A kerosene burning torch is being marketed by the Hauck Manufacturing Company, 140 Livingston avenue, Brooklyn, N. Y. It is similar to the ordinary plumbers' torch, but a longer heating duct is provided to adapt it to the slower vaporization of kerosene. The maker calls attention to the design permitting the use of a cheaper fuel than gasoline and its safety. Complete details and prices are given in the circular, describing the device, which will be supplied upon request by addressing the Houck Company.

SPIRAL GREASE RETAINERS.

The Motor Specialty Company, 2418 North Broadway, Los Angeles, Cal., is producing a device for retaining the grease which has a tendency to work out of the differential case and along the axles inside of the housing. It consists of steel members wound spirally around the axle in such a direction that the grease will be turned back by the rotation of the axle.

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CORRESPONDENCE WITH THE READER.

Piston Rings—Reader, Lexington, Ky.

What care must be taken to remove piston rings and what is the best method?

Because piston rings are fragile they are easily broken when displacing them from the piston unless proper care be exercised in their removal. The rings set into grooves or recesses in the piston and to displace them they must be sprung, or in other words, the diameter of the ring increased sufficiently to permit it being slipped from the piston.

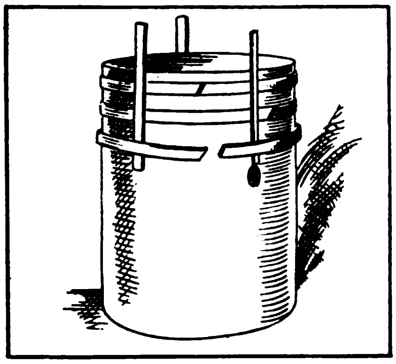

Fig. 1—Illustrating Practical Method of Removing Piston Rings.

A simple and practical method, one generally employed, is shown at Fig. 1. It provides for the use of three thin strips of metal, such as old hack saw blades. Two of the blades are inserted between the piston and ring as shown in the drawing and the third member placed at the rear, equidistant from the front members.

The ring is removed by moving it upward, exerting an even pressure on all sides. The lower ring is displaced first, the middle member second and the top ring last. In replacing the ring the bottom one is first located, then the middle member, and the top one last. Care must be taken to have the slots spaced equidistant from each other when the piston is replaced in the cylinder.

Adjusting Tappets—Subscriber, Fort Worth, Tex.

Kindly explain the construction of the valve mechanism and give me a drawing showing the parts, also how the tappets are adjusted. What is the proper distance between the valve stem and the tappet on a four-cylinder motor?

The components of the valve mechanism are shown at Fig. 2, the drawing being a sectional view. As may be noted, the valve is retained on its seat by a valve spring and is lifted by a tappet or push rod.

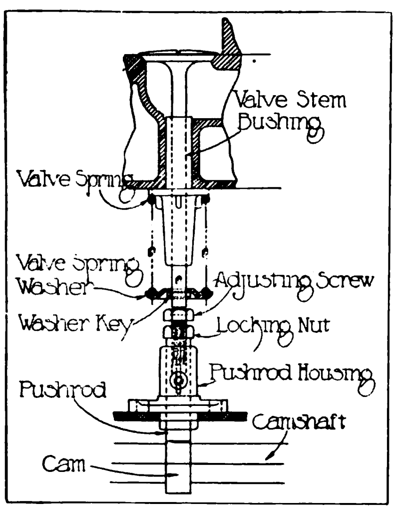

Fig. 2—Components of Valve Mechanism.

This push rod moves freely in a vertical direction in a housing attached to the crank case of the motor, and the tappet is actuated by a cam on the camshaft. When the last-named member revolves, the cam moves the push rod upward, causing the tappet to make contact with the lower end of the valve stem, and a further rotation of the cam lifts the valve stem. During the upward movement of the valve stem the valve spring is compressed but, upon the camshaft completing a full revolution, the valve reseats, as the tendency of the valve spring is always to pull the valve stem down. Adjustment of the space between the valve stem and tappet is obtained by loosening the lock nut and rotating the tappet to the right or left, to decrease or increase the space above referred to. The proper distance to be observed depends upon the timing of the motor, and this information should be obtained from the maker of the car.

Roller Bearings—Driver, Canton, O.

Our delivery car has roller bearings in the front wheels. They are loose. How can they be adjusted? I am told that they are Timken and can be adjusted.

A sectional view of the bearings referred to and employed in the front wheel is shown at Fig. 3. To ascertain if the play be in the bearings, jack up the axle so that the wheel clears the floor, then grasp the upper and lower sections and rock the wheel. Care should be taken not to mistake the play of a worn spindle bolt for that of the wheel bearings. It is a good plan to wedge a block of wood between the spindle body and the axle when testing the wheel for play.

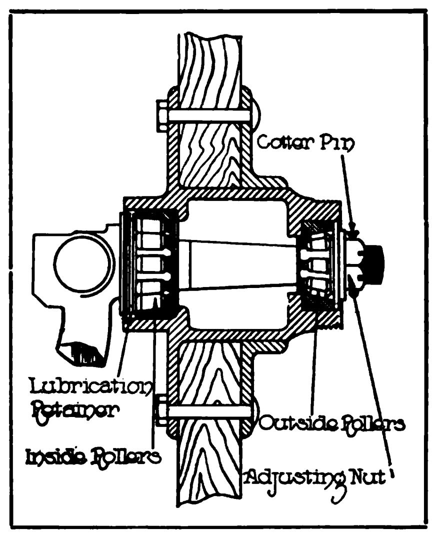

Fig. 3—Roller Bearings and Parts Utilized in Adjustment.

If the bearings are loose they may be tightened by displacing the hub cap, removing the cotter pin, and screwing down the notched adjusting nut. It is best to perform this work with the wheel rotating. Turn the nut until the bearing binds, then slack off until the wheel spins easily and freely. A slightly loose bearing is preferable to one that is too tight, with roller bearings. After making the adjustment, lock the nut in place, and be sure that the cotter pin is inserted and the ends split.

When adjusting bearings it is an excellent plan to remove all of the old lubricant and thoroughly clean all components before repacking with new grease. What is termed a graphite grease is recommended, and the hub cap should be filled with it before replacing it on the hub.

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TWO SIZES OF FREMONT-MAIS TRUCKS.

Internal Gear Drive and Unit Assemblies of Components, Making for Complete Protection and Long Endurance, Features of the Construction.

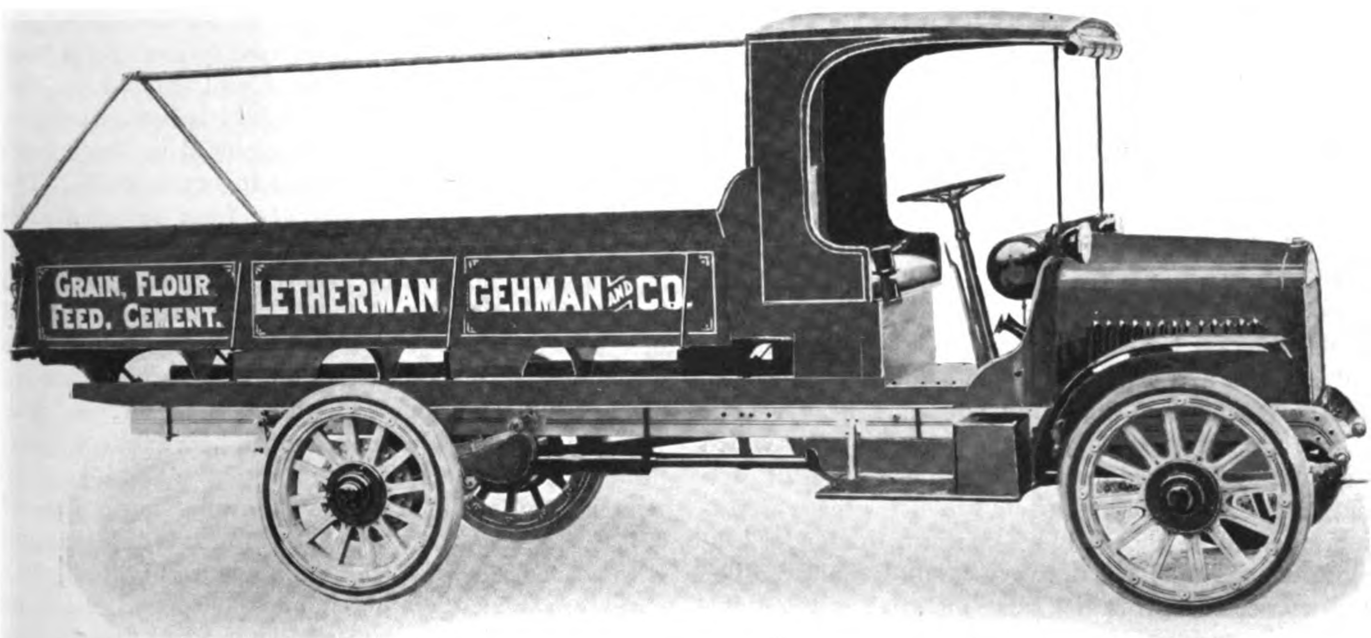
DESIGNED to meet the exacting requirements of American highway haulage, the Fremont-Mais trucks, built by the Lauth-Juergens Motor Car Company, Fremont, O., represent the highest development of the internal gear drive by Albert F. Mais, who is widely known as a motor vehicle engineer, and who has for years concentrated his endeavors to perfecting this form of power transmission.

The internal gear drive system affords complete protection of all moving parts and thorough lubrication, so that friction losses are minimized, and there is practically no loss of efficiency after a long period of service. The load is carried on the dead rear axle, the jackshaft driving the wheels, and the ratio of the spur pinions to the internal ring gears is such that extreme efficiency for the power developed by the motor is consistently realized.

In the Fremont-Mais trucks the greatest degree of simplicity has been sought, accessibility being regarded as an extremely potent factor, and the designs have been so constructed that unit assemblies, each practically an independent group, which can be disassembled and assembled with minimum labor, are a feature of the constructions. Light weight has been secured by the use of high-grade materials, yet there is an unusually large factor of safety. The chassis is made flexible so far as possible with a view of minimizing the stresses resulting from road and load conditions, so that on uneven surfaces driving and braking do not cause excessive wear by cramping moving parts.

As to the different units, the one is the power plant, which is mounted on three points. The control mechanism is assembled with it, as are all the wire and oil connections, and after the removal of a few bolts the unit may be lifted or hoisted clear of the chassis. The second unit is the rear axle, this including the jackshaft, brakes and driving shaft. The third is the front axle, and the fourth is the chassis frame and the springs.

These trucks are built in two capacities, model O, designed for a 3000-pound freight, and model P, which is 5000 pounds rating. These machines are constructed to a standard design and differ only in the proportions of the components. The horsepower of the motor of model O is rated at 22.5, and that of model P at 27.25, by the S. A. E. formula. The power of the engines is conservatively rated and both will develop considerably in excess of the figures stated. Because of the high efficiency of the designs and the fact that there is little frictional loss of power, the machines are adapted for service in conditions where motor trucks would not be believed practical.



Model P Two-Ton Chassis Equipped with a Cab and Express Body with Frame Support for a Cover to Protect a Load Against Storms, This Body Being Considerably Elevated by Longitudinal and Transverse Bolsters.

Every provision has been made to insure endurance in extremely severe service. The radiation system of the power plant is such that there is no possibility of heating, lubrication is unusually thorough, all of the wearing parts either operating in oil or grease, or large oil or grease cups have been fitted, and prac-

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tically all of the operating mechanism is enclosed. The chassis frame is suspended on semi-elliptic springs, the forward set being under the side members, but the rear set being outside of them, this making for a very low centre of gravity and steadiness of the load, as well as facilitating loading and unloading. The machine is driven through the forward ends of the rear springs, which are pivoted on large drop forged hangers, this being a practise very generally adopted in Europe, but which has not been accepted by American engineers and builders. This lessens the weight considerably and eliminates the driving and braking stresses upon the frame between the points of spring support, two factors of material importance.

The Fremont-Mais design is the result of careful investigations made in this country and in Europe, with the purpose of constructing what would be suited for every practical purpose, and in it is represented all that scientific engineering has demanded to secure economy and service longevity.

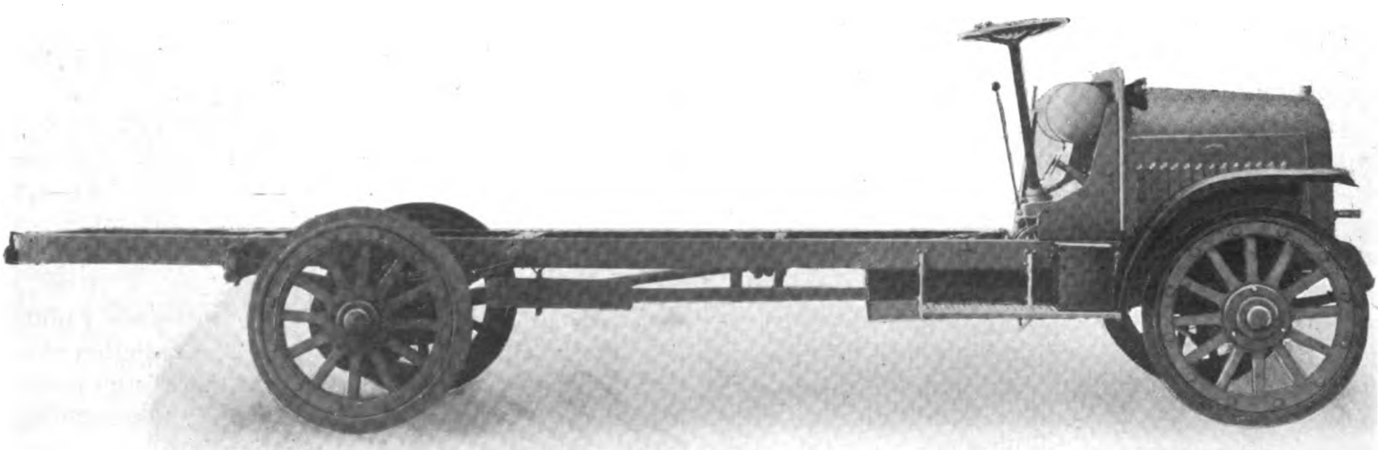
The following description is that of the 3000-pound chassis, and statement will be made wherever necessary with reference to the 5000-pound machine, which differs only in dimensions.

The motor is a water cooled, four-cycle, four-cylinder, L head type, with the cylinder cast en bloc, the valves being on the right side. The block is cast from a special gray iron with the water jacket integral, the top of jacket being open so as to thoroughly clear the large passages and insure free circulation. The top of the jacket is a large cover plate with a central channel to direct the flow of water to the outlet manifold, that is attached to the block by a series of cap screws. Webs are cast beneath the valve pockets, so that the valve stems and tappets may be completely enclosed. The base flange is unusually wide and heavy. The blocks are first tested by water pressure, after which they are bored, aged to allow the fullest effect of casting stresses, reamed and ground to size, great care being taken to have each block conform to standard dimensions. The blocks are very carefully finished. The pistons are cast from the same material as the cylinder blocks and with large bosses to secure ample bearings for the wristpins. The pistons are turned and ground to exact size, being channelled for four eccentric rings above the wristpins, with four oil grooves to provide a full distribution of oil. The piston rings are ground on the outer peripheries and the edges to accurately fit the channels.

The crank case is cast from an aluminum alloy in two sections, the division being horizontal. The upper section has a vertical transverse web dividing it, which carries the centre main bearing, and there is a horizontal transverse web that divides the lower section, this forming the bottom of the crank case and the top of the oil reservoir beneath it. In this web are four transverse troughs or pits, in which is collected the lubricant for the splash lubrication. At the forward end is the usual extension to house the timing gears, which housing is integral with both sections, and which is closed by a cover plate. At the rear both sections are extended to form a housing for the clutch, the upper portion of the bell being removable to reach the clutch. The rear supporting arms of the power plant are cast integral with the housing, and the upper section of the crank case has on the left side the brackets that support the magneto and the water pump and shaft.

The crankshaft is a special quality steel drop forging, heat treated and machined and ground to size, with a flange to which the flywheel is bolted integral with the shaft. The shaft is mounted in three large nickel babbitt bearings retained in brass shells. The connecting rods are drop forged from selected steel and are I section. The big end bearings are nickel babbitt in bronze shells and these are clamped with heat treated nickel steel bolts. The wristpin ends of the connecting rods are fitted with phosphor bronze bushings, the rods oscillating on the wristpins that are fixed in the piston bosses with retaining screws. The wristpins are case hardened open-hearth steel, carefully ground and finished.

The camshaft is drop forged from a single piece of superior open-hearth steel with the cams integral and with a flange to which the timing gear is bolted. The shaft is machined, ground and case hardened, the cams and bearings being accurately ground and fitted. The timing gears are made with flanges to prevent end



Side View of the Fremont-Mais Model P Internal Gear Driven Chassis, Showing the Extreme Simplicity of Construction.

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play and are helical cut, with wide faces, and are practically noiseless in operation. Especial care is taken to maintain gear centres. Unusual attention has been given to the cutting of these gears. The set consists of the crankshaft, camshaft, pumpshaft and idler gears. They are completely enclosed by a readily removable cover plate and can be taken out quickly when necessary.

The valve ports are large and the valves are made with nickel steel heads to which soft steel stems have been electrically welded. The valves are carefully fitted and are interchangeable. The valve stems operate in long bushings that may be renewed when worn, and the springs are large and specially tempered. The valve tappets are a mushroom type, designed to prevent leakage from the crank case, that are adjustable by screws and nuts. The tappets are mounted in long guides carried in the base flange of the block. The valves are protected by two pressed steel plates that are retained by winged nuts that are readily removable.

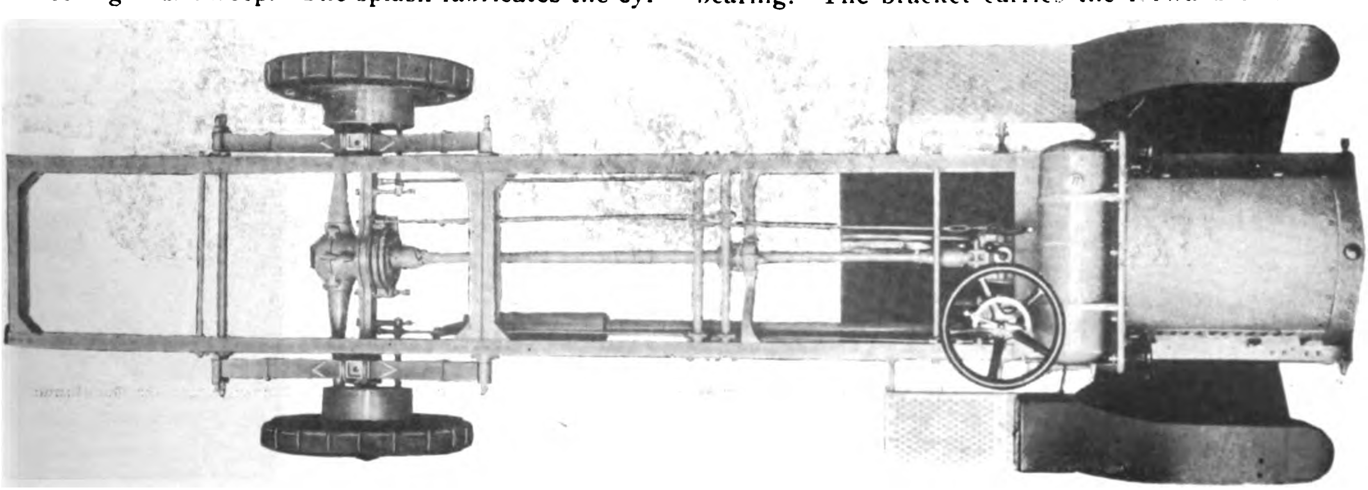
The cooling system of the power plant includes a large capacity finned tube radiator that is spring mounted on the forward end of the chassis frame, through which water from the motor is circulated by a bronze water pump of centrifugal type mounted at the left side of the crank case, with the inlet manifold at the base of the water jacket. The radiator is cooled by a fan mounted on two sets of ball bearings on an adjustable bracket on the forward cylinder, that is driven by a flat belt from a pulley on the extension of the water pump shaft.

The motor is lubricated by a combination force feed and splash system that is said to be extremely efficient. The oil is carried in a reservoir in the base of the engine case, and after being filtered by a screen at the inlet is drawn by a plunger pump driven by the camshaft and forced through a pipe in which is a sight glass in constant view of the driver. The oil is carried through ducts cast in the crank case and the three main bearings and the timing gears are flooded. The excess oil is drained into the base, where it collects in the troughs into which the big ends of the connecting rods sweep. The splash lubricates the cylinders, pistons, connecting rods, wristpins, camshaft and valve tappets, and the overflow drains into the reservoir. The end main bearings of the crankshaft and the bearings of the water pump shaft are fitted with oil deflectors, which prevents the lubricant leaking from the crank case. The oil pump and the screen are removable from the outside of the crank case should occasion require. The level of the oil in the reservoir is indicated by a gauge near the combination breather and filling tube.

The fuel is supplied through an automatic float feed type of carburetor that is stated will afford a satisfactory mixture at all speeds. The intake manifold from the carburetor is designed to afford free passage for the gas. The fuel ignition is by an Eisemann high-tension magneto, with a fixed position for the spark. The motor is fitted with a large exhaust manifold that insures against back pressure and the complete scavenging of the cylinders.

The clutch is a cone 13 inches diameter and three inches width, with facing of chrome tanned leather applied over springs that insure easy engagement, and which can be adjusted from the outside of the clutch. A ball thrust bearing is installed on the disengaging collar. The clutch is designed to afford high efficiency and have long endurance, and it is amply protected. The clutch shaft is coupled to the main shaft of the four-speed ratio selective gearset, which is contained in a casing that is so formed that when bolted to the engine case the flywheel and clutch is housed. The gearset case is a very rigid construction, having at the rear end an oil retaining device that prevents leakage of the lubricant. The universal joint is united with the main shaft of the gearset by a square shaft of substantial proportions. The shafts are all heavy and are mounted on annular ball bearings. The wide faced gears are heat treated nickel steel. The speed reductions are as follows: Fourth, .840:1; third, 1:1; second, 1.654:1; first, 3.4:1; reverse, 4.371:1.

From the gearset the driving system includes a tubular shaft with a universal joint at the gearset, the rear end of which is mounted in a bracket carried on a frame cross member. In this bracket is a substantial bearing. The bracket carries the forward end of the



Top View of the Fremont-Mais Model P Internal Gear Driven Chassis, with the Tubular Driving Shaft Supported by a Bracket on a Frame Cross Member.

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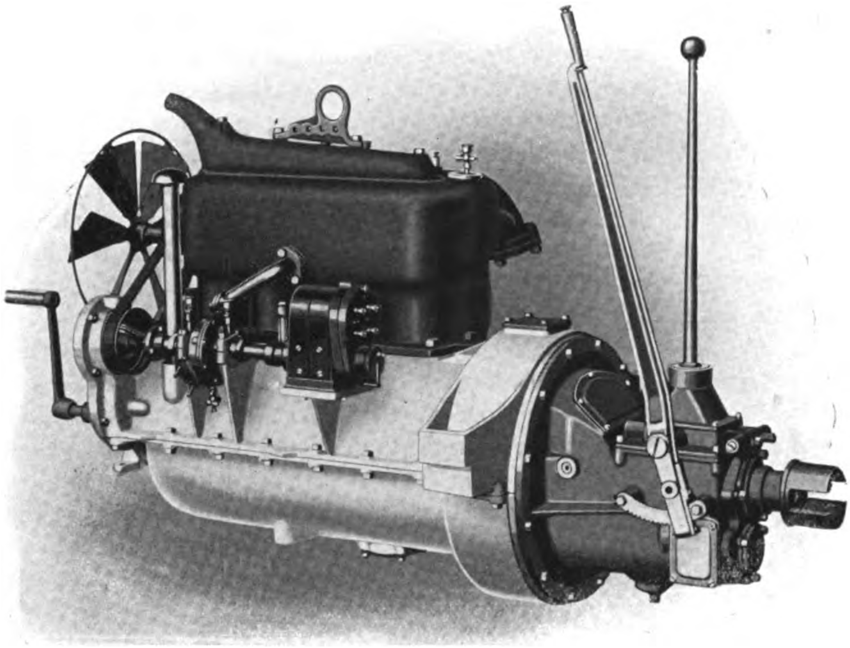


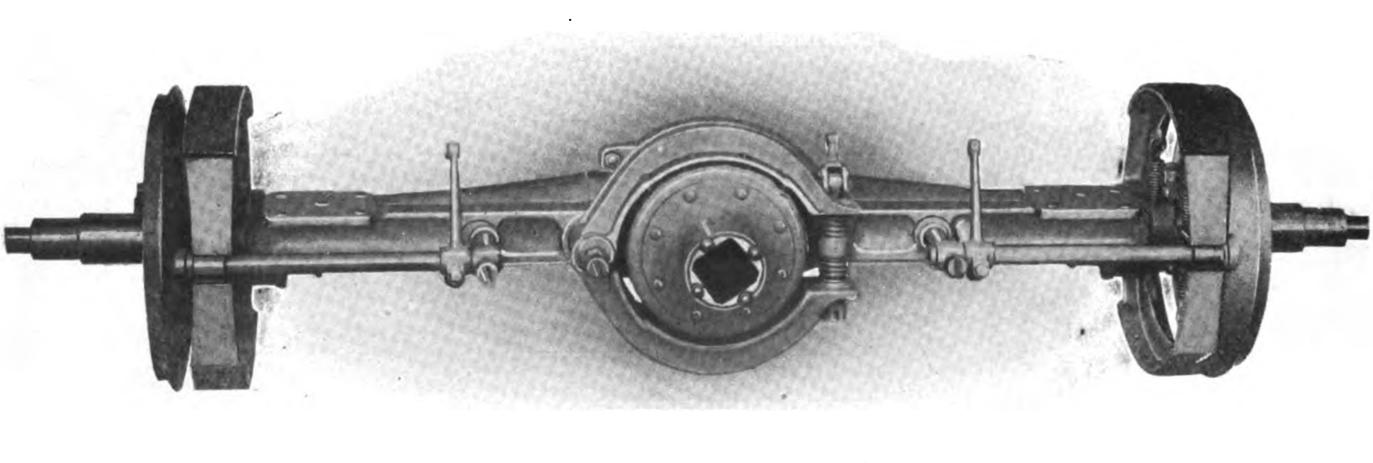
The Unit Power Plant of the Fremont-Mais Trucks, with the Control Levers Mounted on It.

drive from the main shaft is by a pinion. The pinion shaft, the differential and the jackshafts are mounted on annular ball bearings of large capacity. The ends of the jackshafts carry spur pinions which mesh with the internal ring gears in the steel drums on the rear wheels. These drums are 16 inches diameter and the faces are seemingly very wide. They not only house the driving gear, but the emergency brake shoes, which are of unusual size. Reference to the accompanying illustration will show that the jackshaft centres are directly back of the centres of the wheel spindles. In addition to the annual ball bearings the hubs are carried by long bronze bushings, which extend the greater part of the length of the housing between the ball bearings. The construction is comparatively light, very rigid and strong, and is extremely enduring.

tubular driving shaft. There is a universal joint at both ends of the shaft, the rear joint being housed in the forward extension of the jackshaft housing that is mounted on the rear axle.

The rear axle is a steel drop forging with a wide central section in which is an eye or opening through which the housing of the jackshaft is extended forward. This axle is forged with the spring seats integral. At either side of the eye is a bracket that supports the service external contracting shoe brake that operates on the drum on the pinion shaft. At either end, inside the spindles, are the spiders that fit the steel drums of the rear wheels, these enclosing the gears and supporting the outer ends of the brake shafts. The inner ends of these shafts are carried by brackets bolted to the axle. These flanges also support the outboard ends of the jackshaft housing, and the central section of the jackshaft housing is riveted to the rear axle. A rear cover to this central housing protects the bevel gear differential assembly. The

The frame is constructed from a special shaped pressed steel channel with five cross members with the gussets integral, one of which is between the brackets carrying the forward ends of the rear springs, and two tie rods. This is suspended on semi-elliptic springs, the forward set being 42 inches length and $2\frac{1}{2}$ inches width, having 11 leaves, and the rear set 48 inches length and three inches width, having 13 leaves. The front axle is an I section steel drop forging of large dimensions. The wheel spindles are unusually large and are fitted with roller bearings. The wheels are wood, artillery type, each having 12 spokes, and are shod with 36-inch single solid band tires forward and dual tires at the rear. The wheelbase is 132 inches for the 3000-pound truck and 144 inches for the 5000-pound machine, but when desired the light vehicle is built with 144 inches wheelbase and the heavy truck with 132 inches wheelbase. The tread is 58 inches for the forward wheels and 60 inches for the rear wheels.



The Rear Axle of the Fremont-Mais Trucks Without the Wheels, Showing the Service Brake and Emergency Brake Shoes.

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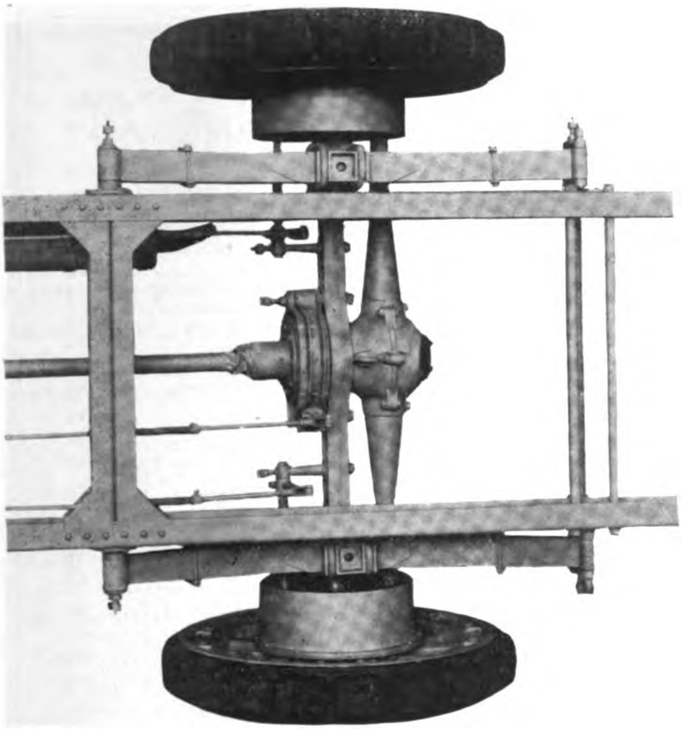


Top View of the Rear Axle and Spring Suspension of the Fremont-Mais Trucks, and the Brake Linkage.

The brakes are very powerful and quick acting. The emergency brake, operated by a hand lever, has drop forged shoes faced with anti-friction material with three-inch faces that are expanded within the drums on the rear wheels, and the service brake is a set of drop forged shoes that are faced with similar material that contract on the drum 10 inches diameter and three inches face on the driving shaft directly in front of the rear axle, this being operated by the foot pedal. The adjustment of this brake is by a winged nut that is instantly accessible.

The steering gear is a screw and nut type that is adjustable by a nut at the base. The steering column is at the right side of the chassis and is mounted on a very rigid bracket bolted to the frame side member, and is supported by a heavy foot bracket bolted to the steel floor plate. The stationary column is 1¾ inches diameter and the wheel is 18 inches diameter. The clutch is operated by the left foot pedal and the service brake by the right foot pedal, the emergency brake by a central hand lever, and the gears are shifted by a hand lever. Both hand levers are placed in the centre of the footboard. Two levers on the steering wheel control the throttle and the air supply of the carburetor. The gasoline tank is a pressed steel seamless tank that has 14 gallons capacity and is mounted on the dash directly in front of the driver, as will be noted from the illustration of the chassis. The lighting is by a six-volt, 80-ampere storage battery that supplies the dash and tail lamps, which will light the machine for 50 hours.

The chassis are sold with or without body equipment. When desired bodies are built to specifications, or they are constructed to standard designs that frequently meet every requirement. The normal loading space is 120 by 60 inches for the 3000-pound truck and 144 inches by 60 for the 5000-pound machine.

NEW LONDON TO BUY FIRE TRUCK.

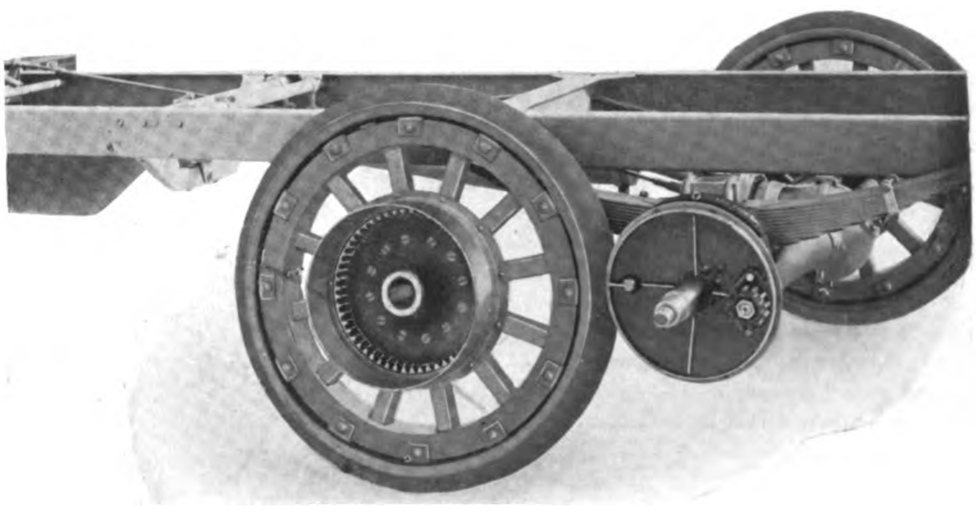
At its last meeting the fire committee of the common council of New London, Conn., discussed the advisability of securing a motor driven apparatus for the F. L. Allen Hook and Ladder Company. Authority to so equip that station had been voted, and the meeting was to decide what make truck would best answer the city's needs. However, as the committee did not have necessary data, it did not make choice. The committee will expend about $10,000 for new apparatus.

HEXTER TO SELL REPUBLIC TRUCKS.

The sale of Republic trucks, built by the Republic Motor Truck Company, Alma, Mich., east of Pittsburg, Penn., is now directed by P. K. Hexter, formerly president of the Hexter Gas-Electric Vehicle Corporation, which has been reorganized as the Roland Gas-Electric Vehicle Corporation, and designer of the Hexter omnibus, which this concern is now building, he having been appointed eastern district sales manager.

PLAN TO BUY FIRE APPARATUS.

Fairfield, Conn., plans to equip its fire station No. 1 with the motorized equipment, the favored proposal being to purchase an automobile chassis, properly equip it and use it as extra apparatus. A recent fire demonstrated the need of such a machine.



Rear Axle of the Fremont-Mais Trucks with a Wheel Removed, Showing the Internal Gear and Brake Drum.

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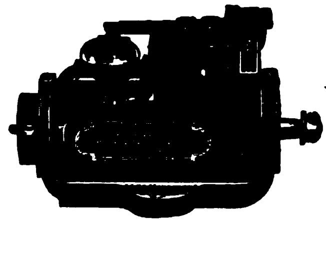

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., MARCH, 1915 No. 3

HOW BIG CONCERNS SERVE TRUCK OWNERS.

Facilities of the Mammoth Station of the Packard Motor Car Company of Boston Typical of the Nation-Wide Organization Developed to Afford the Attention and Oversight Insured by the Manufacturer's Service Policy.

EVERY purchaser of a motor truck or wagon expects to profit through its use, either by effecting economies that are impracticable with animal equipment or by attracting business that is beyond the limitations of existing facilities for transportation. The machines cost considerable amounts and undoubtedly investment is made after careful reflection, so that buyers of motor transports can be regarded as being satisfied that the vehicles they choose will serve their purposes. Few business men will admit that they have ignored fundamentals in administering their businesses, and with rare exceptions will state that they have given reasonable consideration to selecting trucks and wagons.

Thousands of buyers of power vehicles have studied their own needs so far as highway transportation is concerned, and undoubtedly many have made careful estimates from the best information available to them, so that buying is generally with some knowledge of possibilities, but surprising as the statement may appear the majority seldom understand that the results they obtain are entirely due to their own judgment and to the provision they make for care and maintenance.

The Alvan T. Fuller Building, the Salesrooms and Service Station of the Packard Motor Car Company of Boston, Fuller Square, Allston, Boston, 350 Feet Length and 70 Feet Width, Erected in 1909.

The indifference of those who own motor wagons and trucks to the results from carelessness and incompetency cannot be attributed to disregard for economy. In probably every instance that machines have been purchased the purpose was to save—to conserve either time or labor that had a known value, and which could be measured by money. Failure to understand possibilities, which is nothing more than ignorance, especially when these have been pointed out clearly, is the reason for this indifference.

The man who invests from $3000 to $5000 in a truck and then places it in charge of a man, perhaps with no experience with machinery, and who may have driven horses, is incurring risks that seemingly are obvious. The value of the property is sufficient to justify personal attention if nothing else were to be considered, but besides its value is the saving or loss that can obtain through careful supervision.

There are those who obtain large economies by the use of power wagons and trucks. These men either have a realization of their own lack of mechanical and transportation knowledge and secure competent assistance, or they are well versed in mechanics and insist upon practical maintenance and operation.

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These men, however, are decidedly the minority.

Manufacturers Understand Machinery.

As a matter of business, the man who purchases any other machinery than motor trucks will concede that the manufacturer or the engineer who designed it is sufficiently conversant with its uses and production possibilities to regard him as an authority. His advice and experience is at least worthy of consideration. Not only this, in any other service machinery is given good care. But the man who will require a $250 horse to be groomed, blanketed, fed and watered because of the knowledge that neglect will cause inefficiency and loss of service or value, will give no thought whatever to the manner in which an investment of from 10 to 20 times the amount is cared for or operated.

This cannot be attributed to anything else than the assumption, by the majority at least, that machinery will endure abuse and neglect. Either that, or there is a belief that destruction is justified because the builder of the machinery is responsible and will in self protection maintain it constantly operative, no matter what the cause of wear and deterioration.

Large Concerns Protect Themselves.

The largest concerns manufacturing motor trucks and wagons have experienced the conditions referred to. They have learned the possibilities of demands by owners of the machines they build and the consequences of taking at their face value the representations made to them. They have proven that they must precisely define their own responsibilities and conscientiously live up to them, and they must exact that the owners of vehicles afford such protection as would be at least expected of any other property of value.

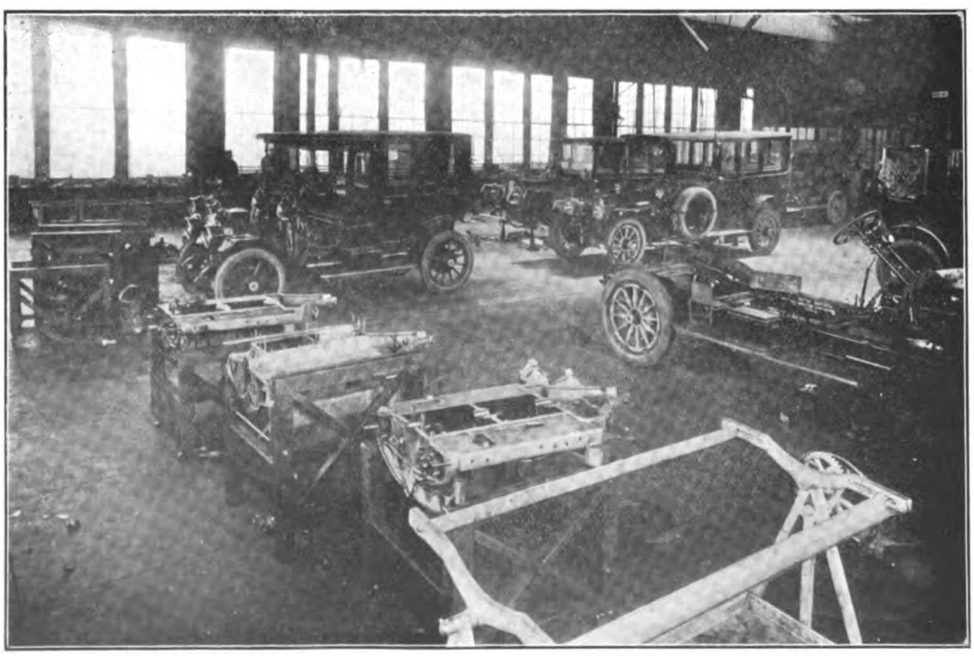
But the progressive manufacturers have gone further than any other industry in that they have established and maintain at their own expense systematized protection for their customers. When business is transacted throughout the country there is need of having available in differing commercial centres stores of parts from which can be supplied whatever may be needed for maintaining the machines constantly operative. If a single type of machine were built the investment represented by a stock sufficient to meet the requirements of owners would be considerable, but when a number of types are produced, and a series of parts for each type must be kept, the value is rapidly increased. And with each succeeding year the money represented, and which is not productive in the same sense as any other investment, becomes larger, the cost of care increases, and it must be given protection. Not only this, the selling cost must be kept as low as possible.

Policy Based on Good Judgment.

Such a policy is in no way different from those of large manufacturing concerns, but the only advantage to the manufacturer is the saving of time for the customer, for orders by wire received at almost any factory, wherever located, can be filled in practically the time required for transportation. But generally speaking only concerns of considerable proportions can afford the expense incurred through the maintenance of such stations. Obviously, this protection is considered in the prices established, for no business is a philanthropy.

Beyond this, however, is the conduct of shops where machines can be repaired or restored to serviceability by men who are expert with them, and supervision that insures to the owner the information that he cannot or will not obtain, and which is necessary to insure economical maintenance and constant operation.

The service organization of the Packard Motor Car Company exists in all parts of the country, and the claim is made for it that no matter where a Packard car or truck may be the owner can obtain the same degree of attention, and be certain of consideration equal to that which would be given by the branch or agent from which the machine was purchased. This is a policy that has been carefully developed and the methods have been systematized so that there is no possibility of misunderstanding or error.



Section of the Repair Shop Where the Motors Are Worked On, the Bed Frames Shown Being Used to Elevate the Engines to Afford Complete Accessibility.

As to the use of motor trucks, the Packard service policy is applied in precisely the same manner as it is to pleasure cars. Wherever there is a branch or an agency of the Packard Company two qualities of service can be depended upon, complete stocks of parts sufficient for the requirements of the vehicles in the

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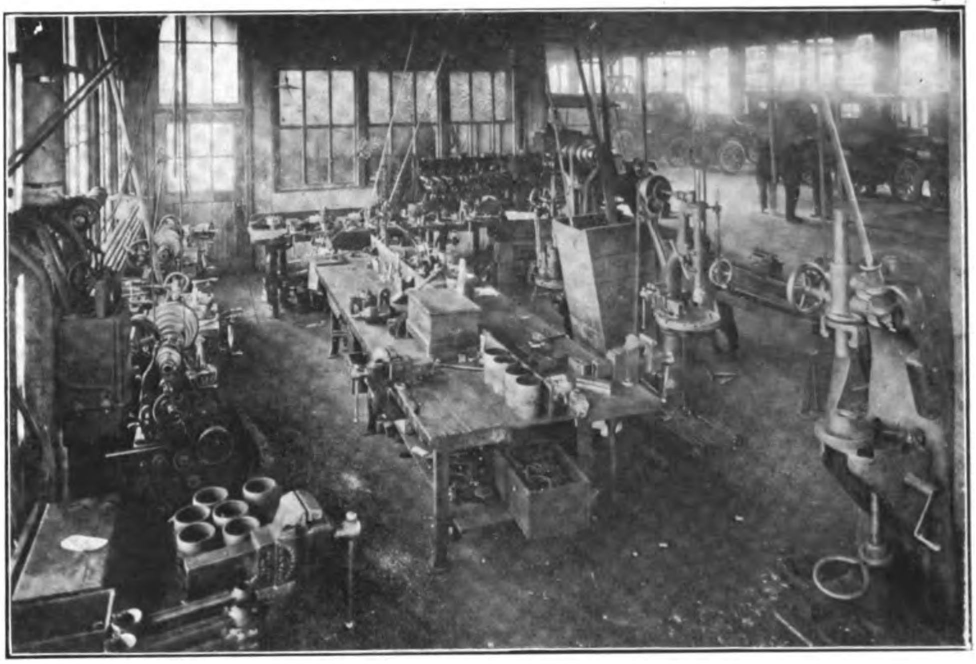
section served, and skilled workmen who are competent to do any work that may be necessary. The truck may not be a long distance from the place of business of the owner, but there are frequently needs for temporary or permanent repair, and the assurance of the Packard Company to its customers is that Packard service, attention and prices are the same.



The Machine Tool Department of the Fourth Floor of the Service Station, Given Over to General Mechanical Repairing—The Room Beyond the Tools Is the Blacksmith Shop.

The Packard Motor Car Company of Boston is more than a branch, for it controls the greater part of the New England business in Packard machines from its headquarters in Boston and its branches in Providence, Worcester and Portland, Me. This concern is typical of the Packard organization and it maintains at Fuller square, Allston, Boston, what is claimed to be the largest service station in America, if not in the world. This station is probably the most representative of all those included in the Packard organization, in that it was planned and constructed with a view of meeting future requirements of the business, and while it was popularly believed to be so much in excess of needs as to evoke criticism of the judgment of the builder, the structure today is entirely inadequate and will, in all probability, be enlarged during the present year.

The Boston Service Station.

The structure was erected in 1909 and was occupied in December of that year. It is 350 by 70 feet, four stories and basement, constructed of stone, concrete and steel, and has a floor area of 122,500 square feet, or 2.82 acres. It was built as nearly fireproof as is possible, in such a location that it is lighted from both sides and ends, and provision was made by factory windows to make work practical in any part of the building without artificial illumination. The site is well into the suburb of Allston, but it is in Commonwealth avenue, which is the principal thoroughfare to the city from the west, and it is really far more accessible than were it in a business section of the city.

The station has a yard of considerable size, and the surface slopes so that one side of the basement, for perhaps a third of the length, is lighted by windows and it can be entered from the yard. The basement contains the heating plant, the big locker room for the employees, two recreation rooms arranged for the workers to eat their lunches and pass their idle time, and a large garage that is used for storing the machines used in connection with the business, and the wash stands. This garage is entered from the drive at the side of the building.

The front of the first floor is the sales room, in which several machines are displayed, and connected with this are the offices of the executive, Alvan T. Fuller, and the general manager and the department managers. The remainder of the floor is given over to storage of machines that are being repaired or adjusted, a considerable part of the rear end being devoted to trucks. One entrance for vehicles is from the yard and through an elevator that will take the largest truck, one end of this being accessible from the yard and the other from the main floor. In addition there are other entrances direct from the yard.

The front of the second floor is occupied by the accounting department, and a large section is used for the stock room in which is a full series of every part required for the maintenance of every type of Packard car or truck, this being a supply for each model vehicle that has been built by the company, the number being dependent upon the types of vehicles known to be in use. The stock room has been increased each year because of the addition of new models and the volume for each series has been as often adjusted. This stock is roughly estimated to have a value of $250,000, and besides the actual components of machines every form of equipment is on hand aside from tires, for only a sufficient stock of shoes is carried to meet the demands of the machines used by the station. Tires are not sold as stock.

Back of this department is a section in which bodies and some new cars are stored. In many instances the owners of machines who have two bodies, as open and closed, for instance, keep one at the station and use the other on a single chassis, making change when weather conditions impel. These bodies are stored and cared for by the company. In this department is also a number of new bodies, each in a space that is marked with the type and the number, these being

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covered to protect them from light and dust.

Repair Department on Two Floors.

The office of the truck sales department is at the front of the third floor, and on this floor, which is largely given over to storage, is the woodworking shop, the upholstery shop, the top making shop, the paint shop and the varnish room, where work of every character, generally restoration and refinishing, is done.

The fourth floor is the repair shop, and practically a half acre of space is utilized for work of every kind. The stairways, elevators and blacksmith shop are on the yard side of the building and require about 100 feet of the length, but around the remainder of the structure is a work bench that is upwards of 600 feet length. Being against the walls, the benches are splendidly lighted, and of course at intervals are vises and other necessary tools. One bench is unbroken for 350 feet, and as is shown in an accompanying illustration, the custom is to line machines head on to this bench with sufficient space between them and the benches so that the mechanics can work conveniently.

Part of the First Floor Where the Motor Truck Chassis Are Repaired, the Machines Being Disassembled Here and the Work Done in the Different Departments.

The greater part of this bench is used for work on pleasure cars, but a section at the rear is given over to trucks. Strange as the statement may appear, comparatively few trucks are undergoing repair work of importance at any one time. The rear end of the floor is devoted to motor repairing, there being a series of bed frames in which these are placed for dismantling and assembling. Beyond this is a section where steering gears are overhauled, and then there is the machine shop and the blacksmith shop. The machine shop is equipped with every power tool that would be useful, lathes, arbor presses, drill presses, shapers and grinders, where whatever is necessary can be done. At this season of the year the station is extremely busy, because of the overhauling, refinishing, etc., that is usually desirable at the conclusion of a winter.

Company Has Three Branches.

So much for the facilities of this station. The company has at its branch in Providence, R. I., a station that is smaller, though equally complete so far as its stock and facilities are concerned, but at Worcester and Portland the equipment is sufficient to do ordinary work, the policy being to send overhauling to the Boston station, where specialized work can be done.

At Boston the company has specialized its work men, so that there are those who can be classified as experts on motor, on clutches, transmission gearsets, rear axles, magnetos, carburetors, lighting and starting systems, and on other forms of repair work, so that the owner has the services of men who can do good work quickly, and with the knowledge that all repairing is guaranteed to be satisfactory. Quick work means minimized cost for labor and at the same time satisfaction is insured. This statement applies alike to pleasure cars and to trucks. As the company has within its territory approximately 350 trucks of different sizes, one will understand that the facilities of the station must be equal to any demands that may be made upon it, for the owners want to keep their machines operative and in use, and withdrawals even for a brief period means expense, especially if other vehicles must be rented to replace them.

Thus expeditious work has a double value to the owner, because it means lessened cost for labor and the lowest practical expense for hiring a vehicle or of paying for the haulage while the machine is being repaired, an obvious economy the company has provided.

The company sells trucks on a definite basis, and it means that this shall be understood. Whatever it contracts to do it will do, and beyond that it is not regarded as being obligated. Its attitude is best set forth in the statement of service policy, which is attached to the face of every retail selling contract. This is as follows:

PACKARD DEALERS' SERVICE POLICY.

New Trucks.

Packard service is organized for the purpose of assisting owners and drivers of Packard trucks to receive from their trucks the excellent results they are capable of giving.

Packard service includes the following:

1. If the truck is delivered to our service department at stated times, we will, during the first year, regularly inspect it monthly and make any minor adjustments that may be found necessary and which can be completed within three hours, without charge to the owner.

2. If the truck cannot be delivered to our service department, then after the first month following delivery, with the owner's permission, or at his request, we will during the first year inspect it monthly and make any minor adjustments that may be found necessary and which can be completed within three hours. For such service we will make a standardized charge based on the distance of the truck, at the time of inspection, from our service department, as follows:

If within a 10-mile radius, $1.50 per inspection.
If within a 20-mile radius, $2.50 per inspection.
If within a 30-mile radius, $3 per inspection.
If outside the 30-mile radius a special arrangement is to be made based upon the distance from our service department.

After the completion of the inspection, which may take from one to three hours, if any repair work ordered by the customer is done, a charge is to be made for labor and materials required, based upon our regular rates.

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3. We will make all necessary adjustments for one month after delivery of the truck, provided it is brought to our service department for that purpose, and has not been tampered with, or injured through accident, overloading or overspeeding. After that time all work will be done in a careful and workmanlike manner at our regular charge for such work, except as noted in clause 4.

4. We will install at our service station without charge, any parts that may be replaced as defective by the Packard Motor Car Company or ourselves under the warranty which is printed below (the standard warranty of the members of the National Automobile Chamber of Commerce) for a period of 90 days after the delivery of the truck to the purchaser.

5. All gratis work under the Packard warranty is to be done at our service station and in the event that an owner requests warranty work to be done at a distance from our service station, the expenses of the work man for transportation, board and lodging, if any, will be charged to the customer.

6. If desired, and within a radius of 100 miles from our service station, we will supply gratis an instructor for a period of three days after the truck is delivered to the purchaser.

7. After the first year following the delivery of the truck, we will inspect it, adjust it and give it necessary attention at our regular standardized charges for labor and material necessary.

After each inspection we agree to send to the owner of the truck and the Packard Motor Car Company a report covering the results of the inspection, the report to be submitted on a standardized form that is furnished by the factory.

It is our intention to give each and every purchaser of a Packard truck fair and business-like treatment. Should anyone not receive such treatment, we ask in good faith to be so advised.

Obligations of Company Defined.

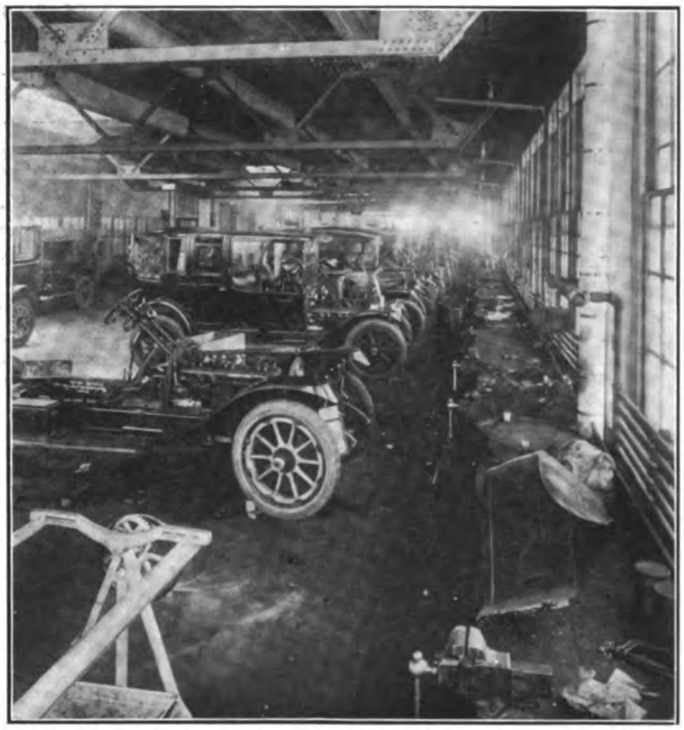
This policy briefly sets forth the obligations that the company has assumed and what it will undertake. The buyer of a truck has these before him in concrete form and he cannot maintain he does not understand them. The company will give a purchaser's driver such instruction as is necessary, his training being dependent upon the man's previous experience, in the shops, where he will work with trained men and will be given a general insight into the general work that is required of him and is necessary to maintain the machine in an operative condition.

The company will provide the service of a trained driver to teach the novice for a period of three days if the machine is used within a radius of 100 miles, and the expert endeavors to instruct him so that the machine will be practically cared for, as the use of the truck is assumedly directed by the owner. The inspections are made regularly for a year when the machine is sent to the service station, the assumption being that as the company gives the services of its men for this work, assuming that three hours is required each inspection, the owner can arrange his service so that this can be done without seriously inconveniencing himself. He obtains full value for the time required for the inspection. In sections at a distance the time of the inspector going and returning and his transportation are not considered, for the price is flat, and the charge does not by any means pay for a man's time.

In the first month the company makes all adjustments that are legitimate when the machine is brought to the service station, and will install all parts necessary under the warranty for 90 days, but all gratis work is done at the station, unless the owner is willing to pay the expenses of the work man. In connection with the inspection a standardized report is submitted to the owner, and a copy of this is sent to the company, and in connection with this such advice as is regarded as desirable is sent to the owner, so that there can be no possibility of misunderstanding. The owner can, through this system of inspection, keep very accurately informed as to the condition of his machines, and learn whether or not they are well kept mechanically and are reasonably operated.

Station Carefully Systematized.

The service station is very carefully systematized, the records being complete and designed to protect the interests of the company and the customer. When a job is received the equipment of the machine is checked, and the work order is made out on a large blank and this is placed in a carrier of leather and celluloid that is attached to the machine by a strap. As the work is done it is checked. The requisitions for stock, signed by the foremen, the time cards, issued by the foremen and signed by the men, and the credits for parts or supplies requisitioned and not used, are included in the carrier with the order, so that the carrier contains a full record of the work and the charges. When the work is completed the record is sent to the accounting department. Every item can be traced if questioned. This insures the company against loss or waste and the owner against overcharge.



Work Benches Extend Around the Fourth Floor. This Illustration Showing 350 Feet on One Side, Each Workman Having a Space for the Machine on Which He Works.

The stock room is drawn upon from two sources—to meet the demands for station repairs and for outside purchases, and for this reason there are two forms of stock requisitions, each of which is distinctive and cannot be confused in the accounting.

The statement concerning the facilities is the standard of the Packard Motor Car Company, for no station representing it is better equipped to afford any character of care or attention, and the service policy of the company is uniform, wherever Packard cars and trucks are sold.

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BOSTON'S BIG MOTOR TRUCK SHOW.

BEGINNING March 6 and continuing until March 13, what will be the most interesting and comprehensive exhibition of motor freight vehicles ever seen in New England, and probably in this country, will be made at Mechanics' building, Huntington avenue, Boston, Mass., by the Boston Commercial Motor Vehicle Association, in conjunction with the 13th annual show of the Boston Automobile Dealers' Association, the former organization has held more exclusive motor truck and wagon shows than any other like association in America, the first being in 1912, and since that time a show has been organized that has followed the pleasure car exhibition until this year, when decision was reached to have the display of pleasure cars and service machines combined, as was the custom prior to 1912, when the Boston Automobile Dealers' Association was the only body repre-

Mechanics' Building, Huntington Avenue, Boston, Mass., Where Will Take Place the Annual Exhibition of the Boston Commercial Motor Vehicle Association, in Conjunction with the Annual Show of the Boston Automobile Dealers' Association, March 6-13.

senting the branches and agencies of the manufacturers in that city.

The exhibitions of the Boston Automobile Dealers' Association and of the Boston Commercial Motor Vehicle Association have always been managed by Chester I. Campbell, and these have been national in character because they have always been the largest shows of America, in number of exhibitors, number of vehicle exhibits, and in productiveness. But because the dealers' association, and not the dominating industrial organizations, profited from the exhibitions, endeavor has been made to "localize" the show through withholding exhibition sanctions. This attitude, however, was in a sense beneficial, in that it concentrated patronage on the exhibitors who were not governed by the sanctioning associations.

The Boston shows have promoted pleasure and service vehicle use more consistently and constantly than promotion has been made elsewhere in the world. More machines were owned in New England than in both France and Germany at the beginning of the European war. New England is the largest purchaser of machines in ratio to population than any other part of the world. It is the one section of the country more than another that the industry can exploit with profit.

Because the Boston show is made at the end of the winter season purchasing at the exhibition is very large. Buyers are attracted to it from every section of New England and following it business is very much stimulated. In previous years the pleasure car display occupied the entire building, which has 105,000 square feet of exhibition space. This year, because of the combining of the two shows, the area available for the exhibits of accessories and supplies has been necessarily limited that the trucks and wagons could be shown, and the entire basement has been given over to this division, so that the show will be better departmentalized than ever before and the visitors will have opportunity of seeing the finest exhibition that has ever been organized for the United States.

The Boston show will be the only national exhibition with a truck department. In this will be displayed practically all of the leading makes of machines, many of which have new types, which will be exhibited for the first time, and for this reason an unusually large number of visitors from other sections of the country will be attracted. Great interest is evidenced in the latest machines built, largely from the fact that they are generally developments of the seemingly universal demand for protection of the mechanism of machines.

The show will be opened at 8 o'clock the evening of March 6 and will continue from 10 in the morning until 10:30 in the evening, March 8 to 13, inclusive.

TOUR OF THE BUICK FLEET.

The Buick North Atlantic fleet, consisting of five pleasure cars and one motor truck, manufactured by the Buick Motor Company, Flint, Mich., has toured through New England, where its several distinctive features, especially the "valve in head" motor, attracted considerable interest on the part of automobile owners and dealers. It was an exhibition tour running on schedule, which was maintained over the roughest roads, in charge of a representative of the company's branch in Boston, Mass.

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KNOX MODEL 35 FOUR WHEEL 10-TON TRACTOR.

Chassis Frame Load Unchanged, the Flexibly Coupled Rear Axle Driving and Carrying the Trailer Weight—Many Novel Features, Including a Hydraulic Brake.

DESIGNED to meet special requirements for heavy haulage, the Knox model 35 tractor, built by the Knox Motors Company, Springfield, Mass., with capacity of 10 tons, is maintained by that concern to have qualities that have not been obtained in other constructions, and which are desirable, if not necessary, to endurance and economical operation.

The company has built tractors for a number of years, first producing the Martin tractors for the patentee, and then building as licensee under the Martin patents, these being known as the Martin and the Knox-Martin machines. These were the well known three-wheel type and in six and 10 tons capacities. The model 35 tractor does not in any manner resemble the Martin type aside from the turntable and its spring suspension.

The experience of the company with freight vehicles dates from approximately its establishment in 1901, and for more than a decade it has built wagons and trucks. The requirements for heavy haulage are well known to its engineers and broad, practical knowledge of the needs for transporting by highway vehicle is reflected in the new machine.

More positive control and better protection of the mechanism have been sought, and statement is made that unusual results have been obtained. Extreme endurance has been secured by the use of carefully selected metals and accessibility has minimized the labor required for attention and upkeep, while improved brakes, more efficient lubrication, limitation of power when a predetermined engine speed is exceeded, and greater conveniences for operation are all factors of material importance that make for greater utility and economy.

With reference to control, the service brake on drums on the jackshaft are extremely large. The emergency brake is hydraulic and affords an entirely different character of braking effect in that it is gradual and always certain, affording precisely the power necessary without jar or jolt, and can be made very delicate. This brake operates on drums having 817¾ square inches of surface area in the rear wheels of the tractor. A differential lock that is interlocking as protection against breakage, will insure traction from one wheel on slippery surfaces, and the service brake is automatic locking.

Knox Model 35 Four-Wheel Tractor with a 10-Ton Trailer, During a Demonstration for the Borden Condensed Milk Company, New York, N. Y.

Features of Construction.

The tractor construction differs from others in that the chassis frame is not mounted on springs fixed on the rear axle, but is coupled with it by two radius rods that rotate on collars on the axle, the forward ends being pivoted to compensate for lateral stress or movement. The frame is short and it is supported by two cantilever springs, the rear ends of which are carried in guides under the rear axle, so there is no side pressure upon the springs, the radius rods preserving the alignment of the axle. The drive from the jackshaft to the rear wheels is by chains. On the rear axle of the tractor is mounted two heavy semi-elliptic springs which carry the turntable, this being a full circle of large diameter, which carries the forward end of the trailer.

This construction insures an unvarying weight on the chassis frame, and the comparatively light cantilever springs more thoroughly absorb the shock and the better protect the mechanism of the tractor, for no shock is directly communicated to the chassis. The traction wheels are thus flexibly connected, and the tractor with its trailer is practically a six-wheeled vehicle with the centre pair of wheels propelling it, the forward wheels being used for steering, the traction wheels carrying the smallest part of the load, and the greater part of the freight being carried on large wheels shod with steel tires.

Motor Regulated Without Governor.

The motor of the tractor is specially designed to obtain regulation of power production when its speed exceeds a predetermined standard without the use of a

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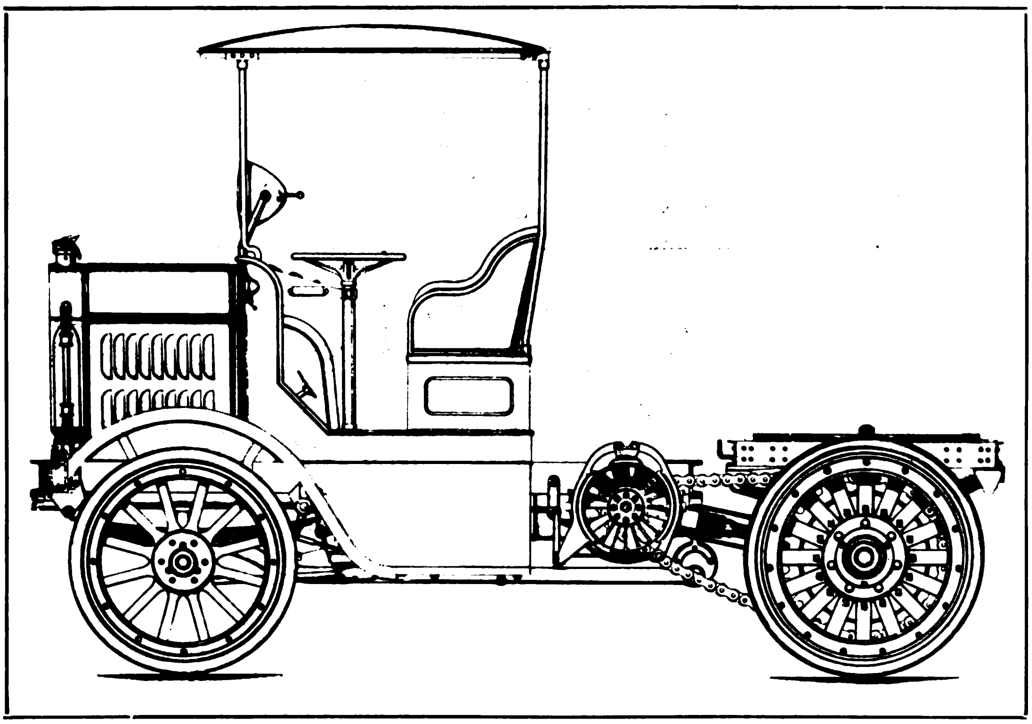
governor, so that when this standard of power is attained any material increase of speed will cause diminished instead of greater power. This is an unusual result which has been accomplished without materially changing the general design or construction, and it is expected in any service the engine will automatically protect against racing and other abuse.

The engine is a four-cylinder, water cooled, vertical, I head type, with the cylinder units cast in pairs with the water jackets integral. The heads are separate casting with water jacket integral. The water jackets are very large. The cylinders have bore of five inches and stroke of 5½ inches, the engine being rated at 40 horsepower by the S. A. E. formula. In general the former Knox design is followed, the valves being the overhead type. There is full accessibility and provision is made to minimize the labor in the event of repair. The cylinder heads have large water capacity and the water connections between the head and cylinder are made with U shaped castings that are bolted to them, so that no water tight joint is made when the head is bolted to the cylinder.



Side Elevation of the Knox Model 35 Four-Wheeled Tractor, Showing the Suspension of the Rear of the Chassis Frame on Cantilever Springs and the Rear Axle Free to Carry the Forward End of the Trailer.

The Characteristics of the Motor.

The valves are a flat seat type that are carried in guides in the cylinder heads, having very large clearance, which insures full aspirations and thorough scavenging, and these are operated by outside pushrods that actuate rocker arms that are mounted on grease tight ball bearings on shafts that are fixed in brackets, each shaft carrying one pair of rocker arms. The motor is lubricated by a high-pressure forced feed system, the main lead of which is a steel pipe cast within the crank case, and from which are outlets to the different bearings. Oil is discharged over the timing gears at the forward end of the motor. A geared oil pump is hung from the upper section of the crank case, this obviating the use of pipe, and a large screen covers the pump and extends to the upper section of the case, where it is secured to a bronze skeleton housing that is integral with a cap bolted to the lower section of the case. When six bolts have been removed the screen may be withdrawn for cleaning without further dismantling.

Varying from conventional practise the exhaust manifold, which is ribbed to secure strength and full radiation, leads forward and down in front of the motor, so that the air drawn through the radiator cools it, and the muffler is suspended in front of the front axle to promote cooling by the free circulation of air. The motor is equipped with a Mea magneto and a Bijur starting and lighting system. The magneto, starting motor and generator and carburetor are mounted well up on the motor, the lowest point of any of these units being 31 inches above the ground, so that the tractor could be operated in 30 inches of water without affecting any of them. The motor is suspended in front from a forged steel beam and the two rear arms are bolted to the chassis frame, a three-point suspension. Sheet steel webs are installed between the engine case and the chassis frame, and the flywheel and clutch are protected by a sheet steel housing. The motor is started by sliding a pinion driven by the starting motor into mesh with a gear cut in the rim of the flywheel.

The clutch is a three-plate disc type of largest size. The transmission gearset is a selective sliding gear construction, affording three forward speed ratios and reverse, and is very heavily built. It is assembled as a unit with the jackshaft. All shafts and gears are heat treated nickel steel, and the shafts are mounted in double row annular ball bearings. The case is a barrel type with the openings for the bearings bored through the case. The jackshaft is a very heavy full-floating construction that is mounted in large brackets. With the gearset is incorporated an interlocking differential lock that is operated by a heel button in the footboard in front of the driver's seat. Because of the interlock the differential lock cannot be used save when the gearset is in neutral, and after locking any speed ratio may be used. This will prevent any damage that might result were conventional practise followed.

Reference to the accompanying illustrations will

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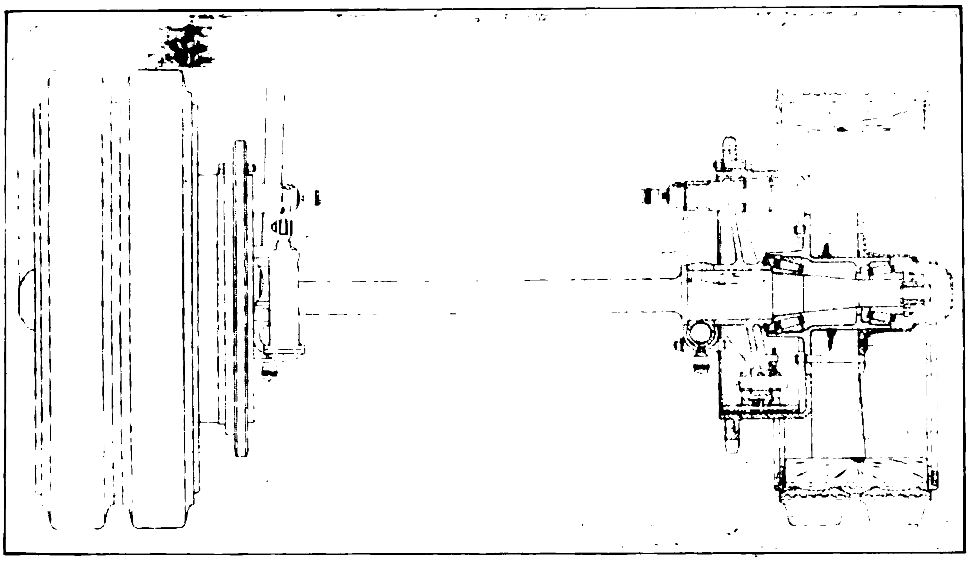


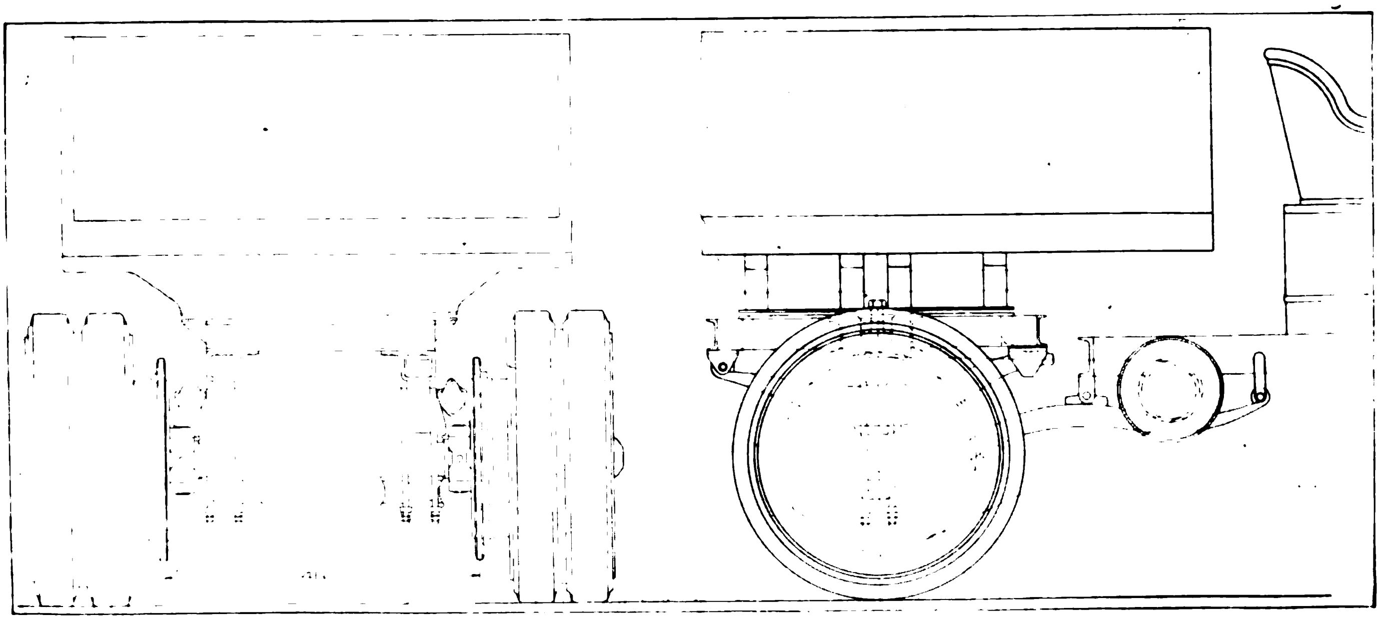
Elevation of the Rear Axle of the Knox Model 35 Tractor, with the Hydraulic Brake Cylinder Attached to the Radius Rod, and a Section of the Brake and Wheel.

The springs are semi-elliptic, those on the rear axle being installed on heavy seats, and carrying a steel frame, the forward ends of the springs sliding in guides and the rear ends being pivoted. The frame is the support for the lower circle or half of the turntable on which the forward end of the trailer is carried, there being an upper circle. There is a stub or stud on the upper circle that serves the same purpose as the kingbolt of the animal vehicle. The trailer perfectly balances the axle when it is attached, but when the tractor is driven without a trailer a drawbar is attached that maintains the platform upright.

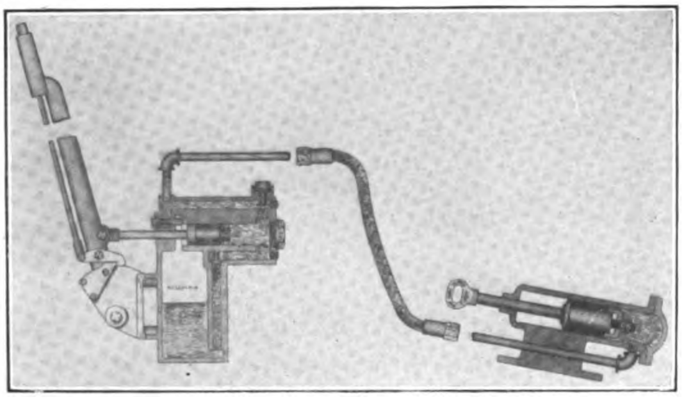
show the tractor to be comparatively short, it having a wheelbase length of 108½ inches, and the chassis frame of heavy pressed steel does not extend far behind the driver's seat. The jackshaft is mounted just ahead of the rear frame cross member. The rear axle is a rectangular section steel drop forging 2¾ by 4⅜ inches, and the front axle is an I section of large dimensions. The rear end of the chassis frame is carried on full cantilever springs that are pivoted on brackets under the rear cross member, the forward ends of the springs being shackled and the rear ends installed in guides under the rear axle. These springs are said to be about a third as stiff as those usually used with five-ton trucks. The resiliency of the springs and the flexible connection of the radius rods and the chains effectually protects the chassis against road shock and stresses that would obtain with the usual rigid rear construction, and there is practically a uniform maximum weight of 3400 pounds carried by the forward wheels.

Wheels, Steering Gear and Brakes.

The wheels are wood, artillery type, the forward with tread of 57⅜ inches and the rear with tread of 55½ inches, from centre to centre of the tires. The forward tires are 36 by four-inch single bands and the rear tires are 38 by six-inch dual. Being practically of standard tread the tractor will follow the usual wheel paths in country roads, which is unusual with machines of heavy construction. The road clearance is 10½ inches under the front axle. The machine is steered by a hand wheel at the left side with the gear shifting and the emergency brake levers in the centre. The steering gear is constructed with very heavy linkage. The service brake is operated by a foot pedal by which contracting cast iron shoes of the locomotive type are clamped on cast steel drums 14 inches diameter and four-inch face. This brake is automatically locked when desired. The drums are fitted with



Rear and Side Elevations of the Knox Model 35 Tractor, Indicating the Mounting of the Turntable on Springs and the Suspension of the Chassis to Be Free of Load Weight.



Sections Illustrating the Hydraulic Brake That is Operated by a Forward and Backward Movement of a Hand Lever from the Usual Control Position.

ribs to radiate the heat.

The hydraulic brake is a novelty of the design. On top of the housing of the gearshifting mechanism is bolted a bracket in which the lower end of the brake lever is pivoted. This lever has a latch by which it can be set and released. Attached to the lower end of the lever is a yoked rod that is fitted to a piston that is slidable in a cylinder. There is an outlet from this cylinder to a system of piping. As the piston is moved in the cylinder oil is forced through the pipe to two small cylinders mounted upright on the radius rods. In these cylinders are pistons that are connected with the shafts that turn the cams that expand the brake shoes within the steel drums on the rear wheels. The leverage is very powerful and by pulling the lever backward the oil is forced from the cylinder by the piston coupled to the lever, and through the pipe to the rear cylinders, forcing the pistons of these cylinders upward, and exerting whatever pressure is desired upon the wheel brake drums. The system may appear complicated, but it is in practise very simple. With this brake great power can be obtained, but the application is in a sense cushioned, so that braking may be as delicate as the driver may desire. Being thoroughly enclosed and well made there is no leakage of oil, the complete lubrication prevents wear, and with the brake shoes faced with Raybestos there is no possibility of their efficiency being affected by grease, oil, water or abrasive. This brake can be set wherever desired and is said to have sufficient power to hold the tractor on a heavy grade. This type of brake obviates the necessity of brake rod adjustment when the driving chains are adjusted.

Speeds with Different Gear Ratios.

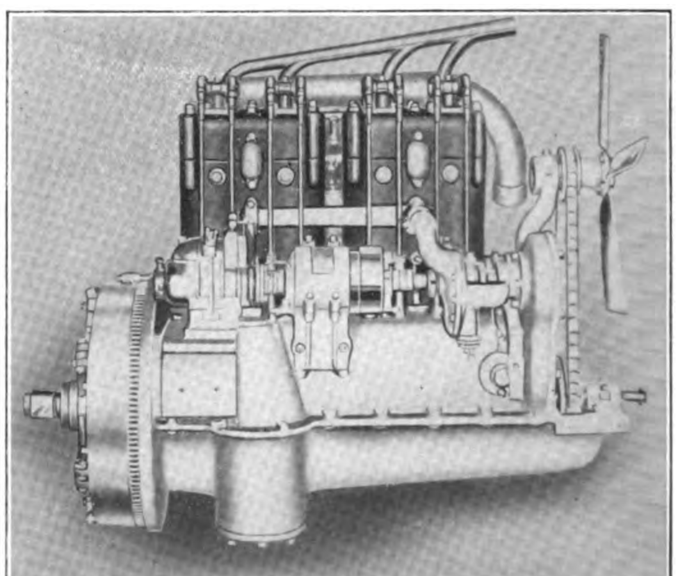
The power of the tractor is very rapidly compounded through gear and chain reductions. At 1000 revolutions a minute the standard gearing of the tractor at high speed ratio has a maximum of 9.4 miles an hour, on second speed ratio 3.9 miles an hour, and on low speed ratio 1.6 miles an hour. By changing the jackshaft sprockets and slight alterations the tractor can be driven 35 miles an hour when used with fire apparatus.

The constructional detail of the tractor has been very carefully developed and besides what has been specified extreme care has been given to lubrication. For instance, there is an automatic trycock that is operated by opening and closing the cap of the oil filler to the engine case, and ample oilers and grease cups are installed so that all moving surfaces in contact may be protected. All of the wires of the electric systems of the tractor are led through flexible metal conduits. Braced between the steering column and the dash is a complete control board in which is set the speedometer, oil pressure gauge, ammeter, lighting and ignition switches and fuses, where all are constantly before the driver. The speedometer is driven by a flexible shaft and a pair of gears installed at the forward end of the countershaft of the transmission gearset.

The 25-gallon capacity gasoline tank, with four gallons automatic reserve, is under the right side of the driver's seat. The tool box is under the left side. The tractor equipment consists of a cab with side curtains, electric dash and tail lamps, swinging searchlight, storage battery, mechanical horn, fire extinguisher, speedometer, two heavy jacks for lifting the trailer, the trailer platform and the usual tools. The tractor weighs about 8500 pounds complete.

MOTOR TRUCKS FOR MAIL DELIVERY.

Motor trucks are being investigated by the United States Postoffice Department as carriers of mail in Boston. The demand by the Boston elevated railroad for an additional $22,000 for its trolley mail car service in transporting mail in Greater Boston led to the investigation. The road claimed that the $50,000 it was receiving for the service was not sufficient to cover the expense incurred by the increased volume of matter caused principally by the parcels post. Assistant Superintendents Gardner and Bumm of Second Assistant Postmaster-General Stewart's office, form the committee of investigation.



The Valve Side of the Knox Model 35 Tractor Motor, on Which is Mounted Water Pump, Magneto and Electric Generator.

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CONVENTION OF ELECTRIC INTERESTS.

ELECTRICAL interests of New England are intensely concerned in a question box convention which will take place at Boston, March 11 and 12, which will be participated in by the members of the New England section of the National Electric Light Association, the New England section of the Electric Vehicle Association of America and the Electric Motor Car Club of Boston. The convention has been organized to meet during the Boston automobile show and the intention is to demonstrate actual concern, to economize in a popular way and to afford the broadest scope for the activities. The delegates from associated concerns need incur no unnecessary expense, for there will be no printed papers, no especially invited speakers, and no special entertainment.

The sessions will be informal in the sense that the subjects will be taken up and considered to such length as may seem desirable, there being no limitation as to discussions, and the questions have been prepared with a view of bringing to the attention of the convention topics that will be generally promotive, and which can be dealt with practically. Should a subject develop unexpected interest, it can be considered without encroaching upon the time of others.

The subjects will relate to central station equipment, facilities, operation, service and administration, to electric passenger and freight vehicles, with batteries and accessories, and with the use of machines for differing purposes. Generally, technicalities will be avoided and attention will be given to what is desirable or necessary for the convenience of the public using electric vehicles.

The convention will have four sessions, at the American house, Hanover street, those of the morning beginning at 10:15 and those of the afternoon beginning at 2:15, after which there will be an informal dinner for those who wish to participate in it the evening of the first day at 6:30.

The first session will be opened with a question box on the subject of "Motive Power", which will include water, steam and gas, and there will be discussions of these subjects: "Generators", "Buildings and Structures" and "The Employee'. At 1 o'clock a luncheon will be served. In the afternoon the subjects will be "Accounting", "Lines" (both transmission and distribution), and "The Customer", the last to be considered under the topics of "Getting Him" and "Developing His Needs". In the evening dinner will be served at 6:30, at the American house, which will be followed by discussion of "Traffic Regulations", "Parking Facilities", "Charging Stations" and other subjects in which the owner and operator of electric vehicles are directly interested.

The morning session for the second day will be opened with a question box and the discussion of subjects generally relating to storage batteries, accessories and equipment for electric vehicles, which will be followed by questions dealing with the use of passenger vehicles. At 12:30 there will be a very important meeting of class A members of the New England section of the National Electric Light Association to act on a proposed amendment to the constitution and bylaws.

The afternoon session will resume the consideration of the subjects of the morning, and this will be followed by consideration of questions pertaining to electric power wagons and trucks. The proceedings will be concluded with discussion of miscellaneous topics.

The convention has been arranged for by two different series of committees, which will lessen the duties of the members and in a sense each day's proceedings will be independent of each other. The committees for each day are as follows:

First day: General manager, Welles E. Holmes; question box, Eugene Carpenter, chairman; J. T. Day, L. L. Edgar and H. W. Eelles; information, LaRue Vredenburgh, chairman; R. E. Hamilton, William Gould, A. E. Greene and James E. Spike; first evening, R. W. Rollins, chairman; C. C. Wells, Albert Mann, Walter L. Mulligan, George W. Holden, A. J. Hixon and C. D. W. Jarvis; ushers, C. Ernest Greenwood, chairman; Ralph J. Patterson, R. A. Berlinger, G. L. Sadler, A. B. Marsden, F. L. Barnes and W. A. Blachford.

Second day: General manager, E. C. Mansfield; question box, Day Baker, chairman; F. J. Stone, A. F. Townsend, V. E. Bird and J. Brodie Smith; information, David W. Beaman, chairman; W. J. Keenan, A. F. Nelson and C. N. Stevens; second evening, C. H. Miles, chairman; F. J. Shepard, Jr., Morton J. Fish, E. A. Barrows, E. W. M. Bailey, Karl L. Morris, R. C. Moeller and George H. Wahn; ush rs, Mervyn F. Falk, chairman; Fred H. Smith, H. H. Van Staagen, S. S. Bell, E. S. Hamblen, W. St. C. Jones and John West.

General committees: City Club relations, J. C. Codman, chair; Charles B. Burleigh, Brooks Faxon, John Campbell and St. John Morgan. Publicity, W. B. Conant, chairman; H. S. Knowlton and William W. Scott.

MOTOR TRUCKS FOR THE GOVERNMENT.

Gasoline and electric motor trucks are to be utilized by the various executive departments of the federal government, Washington, D. C., sealed proposals having been sent to the secretary of the treasury in pursuance to his request, to be opened on March 10. The general supply committee, Auditor's building, Washington, supplied the detailed information and proposal blanks.

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CONTRACT AS WRITTEN STOOD.

Ambiguous Sentence in Letter Cost Tire Company $5000 for Royalties.

In a decision recently handed down in the New York supreme court, deciding a law suit against the Consolidated Rubber Tire Company (now the Kelly-Springfield Tire Company), New York City, writers who make ambiguous statements can find meat for thought. The decision hinged upon a letter which did not clearly state the writer's intentions, and it cost the Consolidated Company $5000 as royalties, and accrued interest from July 1, 1908.

In 1907 the Consolidated Company was corresponding with an English concern, the Reilloc corporation, or its representatives, with a view of introducing an alleged new invention of the company into the United States. The letter that decided the law suit, written from the Consolidated Company's offices, follows, in part: "Now as to the minimum royalty, we would not object to this, in event of our exercising our right to the exclusive use of your device in the states; but, if we allowed you to license others, we would expect to still retain a shop right by payment of 5 per cent. of the net selling price as royalty, it being understood that we are to have one year to determine whether we wish the exclusive right or not by the payment of a minimum royalty of $5000 per year".

The meaning meant to be conveyed by the writer, the company declared, was "the payment of a minimum royalty of $5000 per year for the post-option years".

Justice Goff wrote the decision, and it contains points of great interest to both parties to such contracts, especially on the score of ambiguous language in contracts.

JEFFREY QUADS FOR FRANCE.

The first shipment of Jeffrey Quad motor trucks toward filling the $1,000,000 order recently placed with the Thomas B. Jeffrey Company, Kenosha, Wis., by the French government for its troops, occupied 72 flat cars. This is a rush order and the balance is being shipped as rapidly as possible. The company states that Jeffrey Quad trucks are now in use in six European nations. The Canadian contingent recently sent to Europe was equipped with 32 of the new four-wheel drive, steer and brake Jeffrey machines.

LAUTH-JUERGENS INCREASES CAPITAL.

A resolution to issue $100,000 in 7 per cent. preferred stock was recently passed by the Lauth-Juergens Motor Truck Company, Fremont, O. The additional funds, it was stated, were necessary to put through an order for 300 trucks for the allied armies.

IMPORTANT FUEL DISCOVERY.

A method of making gasoline from white kerosene, vaseline, fuel oil, paraffin, ordinary lubricating oil, or any similar hydrocarbon has been announced as the discovery of Dr. Walter O. Snelling, in charge of the Pittsburg, Penn., research laboratory of the United States government. Dr. Snelling recently demonstrated his process before the Pittsburg Industrial Development Commission. Placing a quantity of ordinary lubricating oil in a steel, air-tight retort, he heated it until a register showed an interior pressure of 800 pounds. When cool the oil was poured out, it having become a dark green and had the characteristics in color and odor of Pennsylvania crude oil. This fluid he distilled and then showed that he had a yield of about 15 per cent. gasoline and about 2 per cent. natural gas.

"It is not certain yet", said Dr. Snelling, "that this method is capable of practical application in oil refining, in view of the fact that the pressure employed is high for commercial work. On the other hand the remarkable results obtained are of such nature as to lead, without doubt, to efforts being made to build apparatus of large size for such work. But the success of these experiments cannot now be foretold".

NEW MANAGER OF RUTENBER MOTOR.

The directorate and board of officers of the Rutenber Motor Company, Marion, Ind., underwent a change of membership when R. O. Berger, vice president, and J. W. Stephenson, treasurer and general manager, resigned their offices. The new vice president and general manager is R. A. Vail; the treasurer is S. R. Chenoveth. P. A. Watson was elected a director. It is stated that while Mr. Stephenson resigns as an active officer of the company, he still remains a director, and retains his financial interest.

JITNEYS AS COMMON CARRIERS.

A bill introduced into the New York assembly by Assemblyman G. F. Thompson provides that all passenger carrying motor vehicles in New York state's cities of the first class, excepting New York City, shall be considered as common carriers. Stage coaches and 'buses operating in state highways or routes that have been constructed wholly or in part by the state are exempt, according to the bill.

BIGGERS GOES WITH HYATT.

With headquarters at the Detroit office, though he intends to spend much of his time in travelling, W. E. Biggers has taken up the management of the Hyatt Roller Bearing Company's advertising department. Mr. Biggers was formerly with the Packard and the Ford companies.

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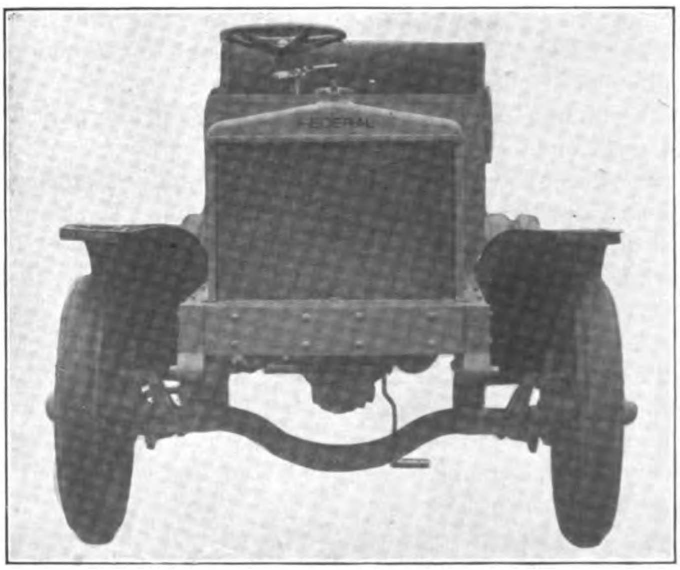
FEDERAL MODEL L WORM-DRIVEN TRUCK.

FEDERAL motor trucks are known throughout the United States as being well built, well balanced economical machines, that have been proven by practical service. The Federal Motor Truck Company, Detroit, Mich., was one of the first concerns to adopt a policy of making a single type machine, and the company from its inception until last autumn continued this, producing a 3000-pound wagon to a standardized design. This truck was chain driven, a conventional type that was representative of sound engineering, constructed of high-class material, and with extreme care to insure endurance and long service.

Because of the demand for those who favor the worm and gear wheel system of power transmission, a machine was designed and perfected that was first placed in the market Jan. 1, this being an adaptation of the chain driven design to this method of propulsion. The worm driven 3000-pound Federal truck was developed to have every quality of the preceding type, with such perfections as the period of experimentation demonstrated were necessary or desirable.

About the time the development of the 3000-pound worm driven machine was begun work was also inaugurated on a 7000-pound worm driven truck chassis, and this design was determined and the preparations for manufacturing it were completed just prior to the third annual convention of the sales organization at Detroit in January. During the convention the experimental machine was shown and demonstrated to the delegates, they being informed as to the plans for production and selling.



"Head-On" View of the Federal Model L 7000-Pound Truck, with Heavy Chassis Frame and Large Capacity Radiator.

The 3000-pound types had been found to meet the demands of a very large number of business men, but there were services for which these could not be used, and it was to meet the requirements for heavy haulage that the model L, as this machine is known, was built. The branches and agencies of the company are located in all of the principal commercial centres of the country, and as these have been established and Federal trucks are favorably known, the distribution of the 7000-pound truck can be made without addition to selling cost, and at the same time considerably increasing the market.

The company is now building these machines and will, as its factory facilities have been increased to do this work, produce them in whatever numbers are necessary to meet the demand. The model L is built in four chassis lengths, which are designed by the numerals following the model letter. Model L-12 is the standard, this having 12 feet of loading space behind the driver's seat, and the special types are models L-10, L-14 and L-16.

The Federal model L truck is noticeable because of the simplicity of construction, the accessibility of the working parts, and the complete protection afforded the power plant and the power transmission system. The chassis is built so as to secure a flexibility of the frame, that there will not be rigid resistance to the stresses of the load upon the vehicle where the surface on which it stands is not even, or where the wheels are driven over an obstruction in the road. In this design the radiator is spring mounted to prevent strains from chassis distortion, and the unit power plant is suspended in a sub-frame carried at three points, so that there is no side pressure upon the shafts or bearings.

The engine is a Continental model E, a four-cylinder, four-cycle, vertical, L head type, with bore of 4½ inches and stroke of 5½ inches. This is rated by the S. A. E. formula at 32.20 horsepower, but will develop 55 horsepower at 1500 revolutions. As the maximum motor speed is 1160 revolutions a minute, the claim of the Federal engineers that the engine will produce 40 horsepower is conservative.

The motor cylinder units are cast in pairs from a special quality of reverbatory air furnace iron, and in the designing much care is taken to secure heavy base flanges and uniformity of the water jacket walls. The casting is made with the water space above the combustion chamber open, this insuring large passages for the water, while the construction is such that these channels can be freed from every obstruction. The cover plate of each unit is cast separately, these being secured by a series of cap screws. These plates may be readily removed should there be occasion to examine the water jackets. The base flanges are extended to obtain ample anchorage for the valve tappet guides, and webs at either side of the valve pockets serve as seats for the cover plates that are fitted to enclose the valves and tappets and their guides and

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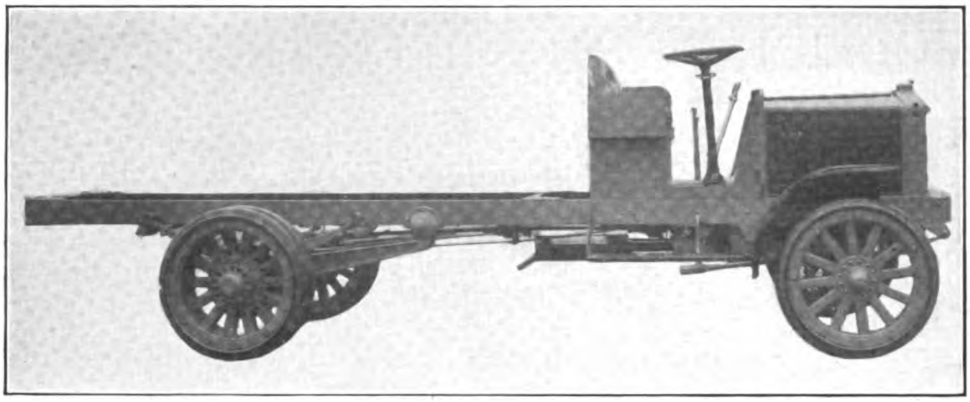


Side View of the Chassis of the Federal 7000-Pound Worm Driven Truck, Which Is Noteworthy for Its Simplicity and Accessibility.

springs.

After casting the units are tested by hydraulic pressure to ascertain if there is leakage. If perfect they are rough bored and aged to develop all distortion from casting strains. They are then reamed and ground to standard size. When the machining is completed another test by water pressure is given, which insures against leaks resulting from the machine work. The pistons are cast from the same grade of metal as the cylinders and they are longer than is usual with normal practise to obviate possibility of side slap. These are turned with channels for four quarter-inch diagonally split eccentric expansion rings, and with five grooves to afford thorough distribution of the lubricating oil on the cylinder and piston walls. The rings are specially machined to reduce all casting strains and are carefully ground on the outer peripheries and the faces.

Much care is taken in fitting the rings to the pistons and cylinders and all motors are operated under separate power to bring the rings to perfect bearing in the cylinders before the final test is made. The seats for the wristpin bearings in the piston bosses are bored and reamed to insure smooth finish and accurate diameter. All the pistons are weighed and carefully balanced.

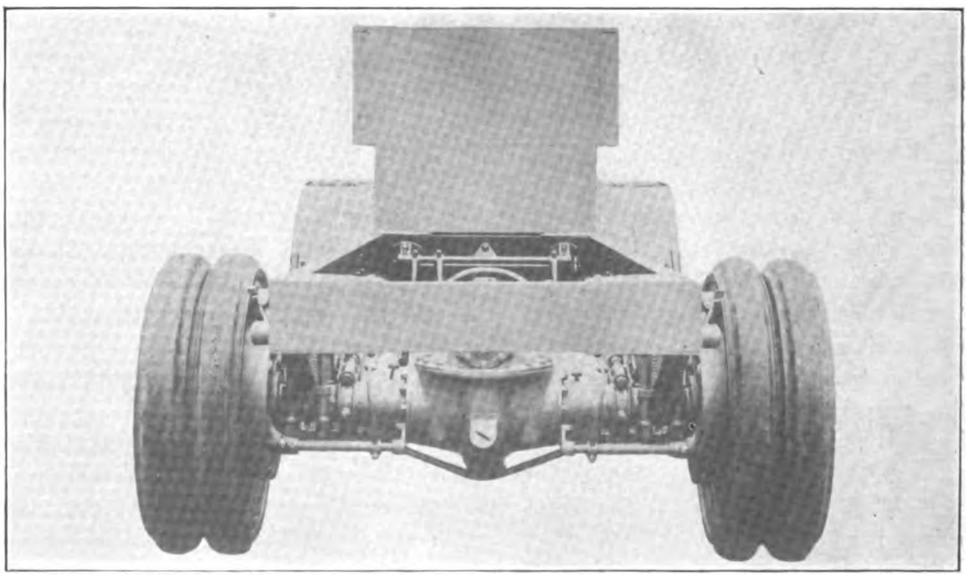
The crank case is cast of a special aluminum alloy in two sections, divided longitudinally, the upper half having the rear supporting arms of the unit integral with the bell housing for the flywheel and clutch. The case is extended forward to form the timing gearset house, and the bell housing is carried back to fully enclose the clutch and flywheel. The upper part of the case is divided by a transverse vertical web in which is mounted the centre main bearing, and the base of the crank chamber is formed by a horizontal lateral web in which are the pits for the oil from which lubrication is by the splash of the big ends of the connecting rods. Below this web, integral with the section, is the oil reservoir.

The crankshaft is a special steel drop forging that is heat treated to give it a tensile strength of 90,000 pounds to the square inch. The shaft is forged with flanges to take end thrust. After machining it is ground to 1 7/8 inches diameter at the bearings and crankpins. The bearings from front to rear at three, 3 11/16 and 4½ inches length, this giving 11 3/16 inches total bearing length. The crankpins are three inches length. The shaft is mounted in nickel babbitt bearings that are retained by brass screws.

Camshaft with Cams Integral.

The camshaft is drop forged from low carbon steel with the cams integral. After being turned and the cams rough machined and annealed, it is specially heat treated and then ground to size. The shaft is constructed so that it may be withdrawn by removing the timing gearset cover. The camshaft is 2¼ inches diameter and the bearings are respectively 2½, 2¼ and 1¾ inches length from front to rear. The connecting rods are I section steel drop forgings that are bored and reamed on special machines to insure alignment and correct centres. These are fitted with white bronze bearings held by brass retaining screws with steel shims to afford adjustment. The connecting rod caps are secured with nickel steel bolts that are locked by a special device. The wristpins are steel tube, carbonized and ground, that are clamped in the small ends of the connecting rods and oscillate in the bearings in the piston bosses.

The timing gearset consists of crank, cam, idler and pump shaft gears, that are helically cut, special



"Rear-End" View of the Federal Model L Truck, Showing the Timken-David Brown Rear Axle of the Worm and Wheel Driving System.

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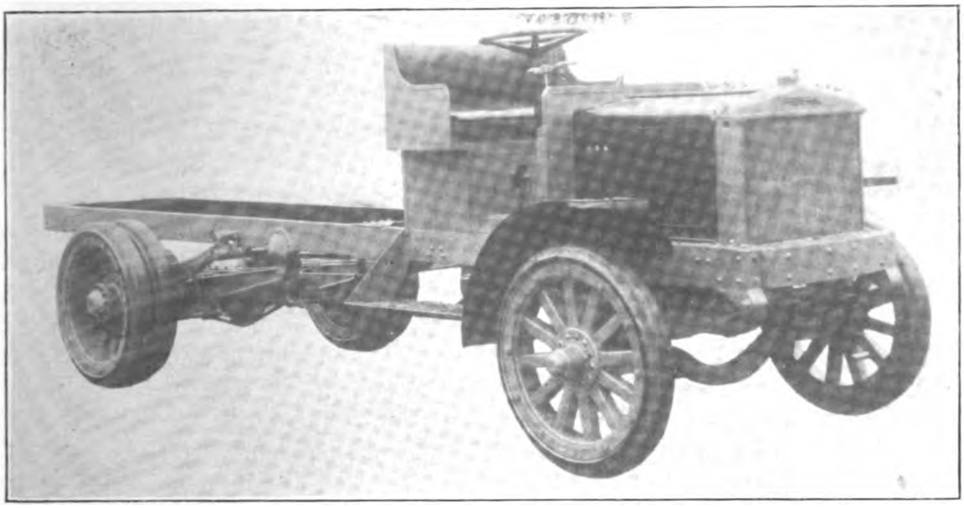


Three-Quarter View of the Right or Driving Side of the Model L Federal Truck.

attention being directed to obtain accurate maintenance of gear centres. These gears are practically noiseless in operation. The valve ports are 2¼ inches diameter and the valves are interchangeable, having nickel steel heads electrically welded to carbon steel stems. There is sufficient clearance to provide free aspiration of the fuel and efficient scavenging of the cylinders of the exhaust gases. The valve stem ends are hardened to prevent wear. The valve guides are long and can be replaced when worn. The valve tappets are a mushroom type, of crucible steel, with the heads and stems ground to size, that are fitted to substantial guides secured to the base flanges of the cylinder units.

Cooling and Lubricating Systems.

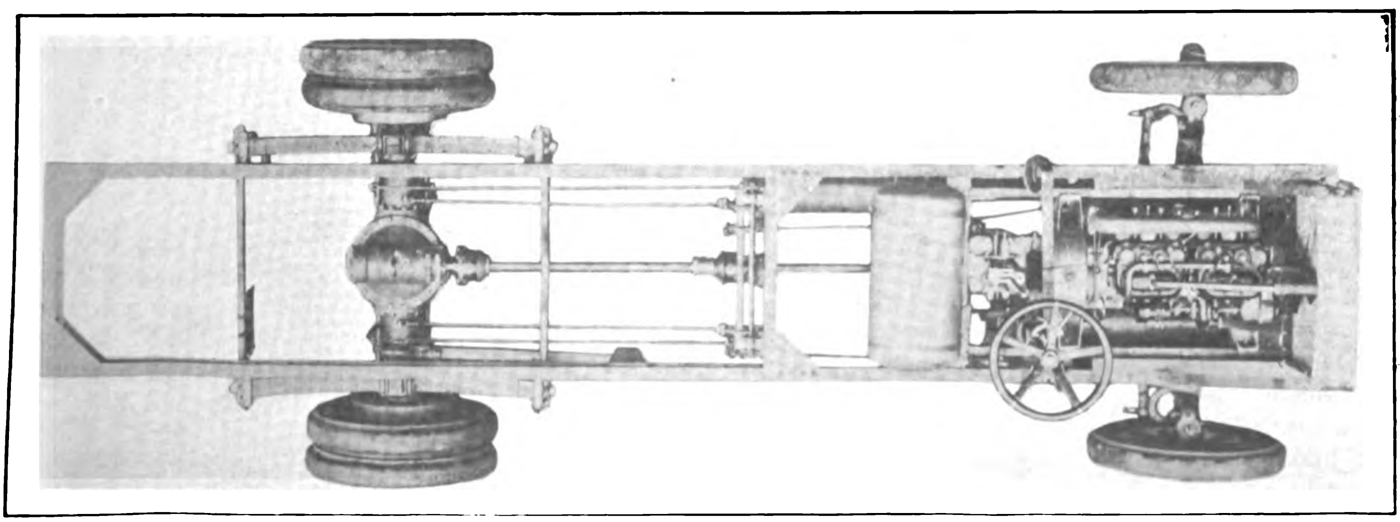
The motor is cooled by a circulation of water that is forced by a large double bearing centrifugal pump through liberal connections with the specially built cellular radiator. This radiator is built with a central section bolted to top and bottom tanks, which can be removed should occasion require, so that damage can be quickly repaired. An 18-inch fan, mounted on a ball bearing seated in a bracket that is adjustable by an eccentric, is driven by a flat belt from a pulley on an extension of the water pump and magneto shaft.

Lubrication is extremely efficient, the oil being drawn from the reservoir through a filter by a double plunger pump driven by eccentrics on the camshaft and forced through tube to the timing gearset and the rear main bearing, the excess oil draining to the pits in the bottom of the crank chamber, whence it is distributed by splash to the cylinders, pistons, centre main bearing, connecting rod crankpin and wristpin bearings, the camshaft bearings, the cams and tappets and guides. The camshaft bearings are supplied with lubricant from pockets cast in the crank case. The overflow of oil from the crank case is drained to the reservoir and again circulated.

The ignition system is supplied with energy by a waterproof high-tension magneto that has a fixed spark. The fuel is carburetted by an automatic float feed carburetor that is claimed to afford an efficient mixture at all engine speeds. The motor is regulated by an automatic governor that is controlled by the velocity of the gas in the intake manifold, which is enclosed and sealed. The maximum speed is 12 miles an hour at 1160 revolutions a minute.

Power Transmission System.

The clutch is a multiple disc type that is composed of 13 steel plates faced with Raybestos, that is operated with triple clutch springs. The discs are not lubricated and the clutch is stated to be easy in engagement and very efficient. It is entirely enclosed. The gearset is mounted in a case that is bolted to the rear of the bell housing. It is a selective design with three forward speed ratios and reverse. The main shaft, countershaft and gears are 3½ per cent. nickel steel, heat treated and specially machined, that are mounted on Timken roller bearings.



Top or Plan View of the Model L Federal Chassis, Which Shows the Frame Construction Designed to Afford Flexibility and the Power Transmission System.

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The main shaft of the gearset is coupled to the driving shaft by a universal joint, and this shaft is carried back and is supported by a self-aligning annular ball bearing mounted on a frame cross member. Back of this bearing is the second section of the driving shaft, which extends to the worm shaft of the rear axle, with an universal joint at either end of this shaft. This construction prevents whipping of the shaft and side pressure leverage in the event of the chassis "weaving" through movement on uneven surfaces.

Timken-David Brown Rear Axles.

The rear axle is a Timken-David Brown full-floating construction, in which the load is carried on the housing. The axle case is composed of a central section, to which two end sections are rigidly bolted. The centre of the housing is a steel casting with a large top opening that is closed with a cover plate that carries the worm shaft, its bearings, the gear wheel and the spur gear differential gearset assembled with it. This assembly is mounted with Timken roller bearings throughout. With the shafts withdrawn the cover and the worm shaft, gear wheel and differential can be removed. When once adjusted and assembled no attention need be given it other than lubrication. The end sections are steel castings with the spring seats and brake spiders integral.

The driving shafts are chrome nickel steel, heat treated, with which are forged integral the flanges that are bolted to the hubs of the wheels. The other ends of the shafts are splined and float in the differential gears. The wheels are mounted on Timken roller bearings. This axle is designed for extremely heavy service. The front axle is a drop forged steel I section 3¼ by 2¼ inches. The large wheel spindles and the pivots of the steering knuckles are fitted with Timken roller bearings. The wheels are wood, artillery type, the front set having each 12 2½-inch spokes and the rear set having 14 3½-inch spokes. The tires used are 36 by five-inch solid bands, single forward and dual rear. The wheelbase is 146 inches for the model L-12, with tread of 66½ forward and 67¾ rear.

Frame, Springs and Brakes.

The frame is built of pressed steel channel section with width of six inches and webs 2⅛ inches, 7/16-inch stock, a construction that is unusually heavy and is expected to be extremely enduring. The frame has four cross members, which are reinforced by large gussets. The frame is carried on semi-elliptic springs of vanadium steel, the forward set being 45 inches length and 2½ inches width, and the rear set 56 inches length and three inches width. The rear springs are outside the frame and the brackets are connected across the frame by heavy tie rods that carry one end of the shackles. The springs are shackled at either end, the entire driving and braking stresses being taken by the heavy radius rods, which are free to rotate on the seats on the rear axle, and are pivoted transversely, to give a free vertical movement.

The brake sets both operate on the rear wheels in steel drums 18 inches diameter and 3½ inches width, the expanding shoes being faced with Raybestos. The brake shafts are connected with direct pull rods and the braking effort is extremely powerful. The steering gear is an heavy irreversible worm and gear type, operated by a 20-inch hand wheel located at the right side, with the throttle controlled by a hand lever on the steering column. The clutch and service brake are operated by foot pedals and the gears are shifted and the emergency brake applied by hand levers in the centre of the footboard. The driving effort of the worm and gear is very powerful, it being with ratios of 10.33:1 on high speed, 18.18:1 on intermediate and 34.7:1 on low, with 44.6:1 in reverse.

The chassis is furnished with a sheet steel seat that is 46 inches wide, with upholstered back and removable cushions. The regular equipment of the chassis includes the seat, dash and tail oil lamps, horn, tool kit, oil can and jack. The gasoline tank is under the driver's seat and has capacity of 28 gallons.

WAR TRAFFIC DESTROYS FRENCH ROADS.

"The driving of cars inside the fighting area", writes George Boillot, who drives a car for Gen. Joffre, and is well known in the United States as a racer, having driven a Peugeot in the last 500-mile race at Indianapolis, "has become a tremendous work, as well as a dangerous one. With cannon and artillery, with lorries carrying food and 'buses carrying troops, the roads have been unable to stand the strain. So, with the rain we have been having lately, it looks as if we were touring in the bed of a river instead of on a road. You can imagine what it feels like to have to be at such and such a place at a given time, and to be held up time after time by mud up to your rear axles".

KELLY-SPRINGFIELD INCREASES.

Indicative of increased business is the statement that the Kelly-Springfield Tire Company, New York City, has opened a new direct factory branch at Dallas, Tex., under the direction of H. L. Smith, as district manager, and has removed its Pacific coast branch to larger quarters in San Francisco, Cal. The new address of the latter is 1147-1153 Van Ness avenue.

MARX HEADS DETROIT-WYANDOTTE.

The Detroit-Wyandotte Motor Car Company, Detroit, Mich., is now headed by Frank Marx, who was elected to office at the last annual meeting of the stockholders. With him in office are the following: W. J. Seitz, secretary; Herman Woelmer, treasurer, and George A. Horner, general manager.

More than $200,000 worth of stock out of the $500,000 at which the Dort Motor Car Company, Flint, Mich., was incorporated, is said to have been already paid in.

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SOUTH AMERICAN TRADE ADVICE.

A booklet containing many valuable suggestions for manufacturers and sales agents interested in extending their foreign trade relations into South American countries is issued by the Department of Commerce through its Bureau of Foreign and Domestic Commerce. The five principal factors governing trade relations in the southern continent are therein summarized as follows: Steamship facilities, investment of American capital, credits, direct personal effort and the necessity for giving the buyer what he asks for.

The last named factor is illustrated by an incident in Guatemala. A large ranch owner there asked a local dealer to buy a large number of neckties of a certain design to which he had become attached by long usage. The order was sent to an American concern, which sent ties of a newer design, accompanied by a letter explaining that the ties asked for were 20 years behind the prevailing style. The neckties were refused, the owner sending his order to Europe, where he was promptly supplied with the articles he ordered.

American trade relations with South American countries have been steadily advancing in recent years, especially since the opening of the Panama canal, and since the war in Europe checked in large measure the volume of trade between South American and European countries. American consuls state that the buyers of the southern continent are looking to its northern neighbors for their products. The booklet referred to, entitled "Consular Recommendations on South American Trade", is listed under Miscellaneous Series No. 20, contains 29 pages of valuable advice, and can be obtained from the superintendent of documents, government printing office, Washington, D. C., at five cents the copy.

NEW DIRECTORS FOR AVERY COMPANY.

Three new directors have been elected to the board of the Avery Company, Peoria, Ill. They are H. A. Rumsey, Henry Robertson and Frank J. Johnson of Chicago. Gross sales of the company for the year ending Dec. 31, 1914, according to the annual report, were $2,848,000. The balance available for dividends, after deducting an appropriation for the redemption of preferred stock and organization expenses, was stated to be $122,032.

MICHIGAN HIGHWAY COST REDUCED.

The board of county commissioners, Wayne county, Mich., in its annual report showed a saving of $7140 in the cost of maintaining all highways of the county outside of Detroit for the year 1914, over that of the preceding year. The total cost was stated to be reduced to $23,392, which was claimed to be largely due to the replacement of certain macadam roads with cement concrete pavement.

ROAD BUILDING CAPACITY.

Legislation to Provide Expert Supervision Favored by Highway Association.

Legislation throughout the United States toward placing highway construction supervisors upon a competitive examination basis has been advocated by the American Highway Association and the National Civil Service Reform League. At the American road congress, held at Atlanta, Ga., Chief Examiner G. R. Wales, representing the United States civil service commission, called attention to the advantages of the merit system in highway construction and forestalled possible criticism that stereotyped technical questions would be propounded in competitive examinations.

"For those high-grade positions where men of experience and attainments are needed", said Mr. Wales, "an examination is given which does not require the competitors to assemble at any place or to answer technical questions. They are called upon to furnish under oath a detailed statement of their education and experience, including all the work they have done since graduation. They may also be asked to submit an original thesis or report or published works, and they are required to give the names of persons able and competent to testify as to their experience and personal fitness.

"Confidential inquiry is made by the commission from various sources as well as of all the persons referred to by the applicant. Gratifyingly accurate and discriminating testimony is obtained by this means of confidential communication. Such testimony approximates, if not equals, the testimony adduced upon cross-examination in judicial proceedings. A proof of the ability of the competitive system to obtain high-class men for technical positions has been made within the past year in connection with the employment of men to appraise the value of the property of common carriers in the United States. For this work the interstate commerce commission required men with qualifications ranging all the way from rod man and chain man to senior positions in civil, mechanical, structural, electrical and architectural engineering, as well as motive power men and expert accountants.

"A system which can successfully secure a competent force of high-grade engineers could surely provide the proper kind of men to have charge of the construction and maintenance of public highways.

"It is anticipated", added Mr. Wales, "that steps will be taken to wage an active campaign in every state for the elimination of the spoils system and to substitute for it the merit system".

Having recently received a large order from Europe for its trailers, the Troy Wagon Works Company, Troy, O., is increasing its plant capacity by the erection of a one-story factory, 120 by 140 feet.

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TRUCK BUYERS OPTIMISTIC.

Walter C. White Says That Prospect Is Forecasted by Large Firms.

General optimism prevails in many important lines of business, according to Walter C. White, vice president and general manager of the White Company, Cleveland, O.

"The activity of the motor industry is now looked upon as a mirror of trade conditions", Mr. White said. "By their readiness to make heavy investments in motor trucks, many representative concerns have shown that they are preparing for a big improvement in business very soon. At the same time they have recognized the motor truck as a big economic factor in business".

Concerns of high standing and commercial wisdom are the most active buyers at the present time, according to Mr. White. The character of the buyers of 249 trucks is shown in the following list:

Adams Express Company, B. Altman & Co., Armour & Co., Atherton Furniture Company, Atlantic Refining Company, Bell Telephone Company of Pennsylvania, B. Baff & Son, Boggs & Buhl, Inc., James Butler, Inc., Clearing House Parcel Delivery Company, Cudahy Packing Company, Diamond Spring Brewing Company, B. F. Goodrich Company, the Good Roads Company, Great Northern Paper Company, Joseph Horne Company, Kaufmann Brothers, Montgomery, Ward & Co., National Cash Register Company, New York Board of Fire Underwriters, Peninsula Rapid Transit Company, People's Gas Light and Coke Company, Pabst Brewing Company, the Rosenbaum Company, Red Rock Company, Standard Oil companies of Indiana, New York, Nebraska and Kentucky, Sherwin-Williams Company, Simmons Hardware Company, Southern Express Company, Southern Bell Telephone and Telegraph Company, Sheffield Farms-Slawson-Decker Company, Franklin Simon & Co., James Thompson & Son, Ltd., the United States postoffice, the Summerfield Company, Holland-American Plantation Company, John D. Rockefeller, Atlanta Milling Company, the Gramophone Company, Ltd., American Sewer Pipe Company, Lansburgh & Brother, the Halle Brothers Company, Supreme Baking Company, Friary Brewing Company, Ltd., Supplee Alderney Dairies, Commercial Brewing Company, Hahne-Stagg Company, the Bailey Company, Fortune Brothers, Brewing Company, Dominion Natural Gas Company, Ltd., Cleveland Milling Company and Gulf Refining Company.

RUSSIA BUYS MOTOR TRUCKS HERE.

A Harrisburg, Penn., dispatch states that a local concern has received from the Russian government an order for 300 armored motor trucks that will cost about $1,500,000.

MOTOR TAXES DOUBLED.

A bill fixing a registration fee for commercial vehicles of $14 for the first 1000 pounds and $6 for each additional 1000 pounds or fraction thereof, as well as many other changes effecting Connecticut motorists in particular, was agreed upon in a hearing before the committee on roads, bridges and rivers at Hartford, Conn., and was sent to the General Assembly. The bill, fathered by Representative Sherwood of Westbrook, provides the following registration fees in addition to the commercial automobile rate mentioned above: Livery automobiles, $20; dealers' automobiles, $100; motorcycles, $4; dealers' motorcycles, $20; all other automobiles, $1 for each horsepower, this tax to be in lieu of any and all other taxes whatever, and amounting to just double of the previous rate, which was 50 cents.

The last named clause of the bill in effect takes away the tax revenue from the towns and gives it to the state, a revenue that is expected to amount to about $500,000 this year. Representatives of the smaller towns at the hearing were said to have stated that they will oppose any suggestion that will take revenue away from their towns.

A bill relating to the establishment of a force of license inspectors, introduced by Albert Phillips, former secretary of state, met with strong opposition.

MOTORKART COMPANY BANKRUPT.

Creditors have petitioned the Motorkart Company, New York City, manufacturer of a light motor commercial vehicle, into bankruptcy, alleging that the company is insolvent, that preferential payments have been made to certain creditors, and that admission that it is unable to meet its obligations in full has been made in writing. No statement is made as to the probable effect this action will have upon the construction of the company's plant in Scranton, Penn. The Power Wagon Publishing Company, Chicago, the Johnson Export Publishing Company and the Indian Refining Company, whose claims are $622, $196 and $50 respectively, are the petitioners.

TRUST BONDS REDEEMED.

That it is ready to retire at par and accrued interest, plus a premium of 2½ per cent., a series of trust bonds issued March 15, 1911, is the announcement from the Velie Motor Vehicle Corporation, Moline, Ill. The date of retirement is set as March 15, 1915.

AUTHORIZES MUNICIPAL GARAGE.

The city council of St. Paul, Minn., has authorized the construction of a municipal garage which is estimated will cost $48,000, $21,000 for the building and about $27,000 for the site.

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ECLIPSE PORTABLE UNLOADING MACHINES.

Apparatus Operated by One Man That Will Transfer from 250 to 500 Tons of Building Material or Coal from Cars to Trucks for Two Cents a Ton or Less.

ECONOMY of time and labor is sought by every business man. It means a greater profit without additional expenditure, or increased production at the same cost. Though this saving is desired, its realization is often a problem that necessitates careful investigation, thoughtful application of methods, continuous supervision and broad observation to avoid the errors and to profit from the experience of others.

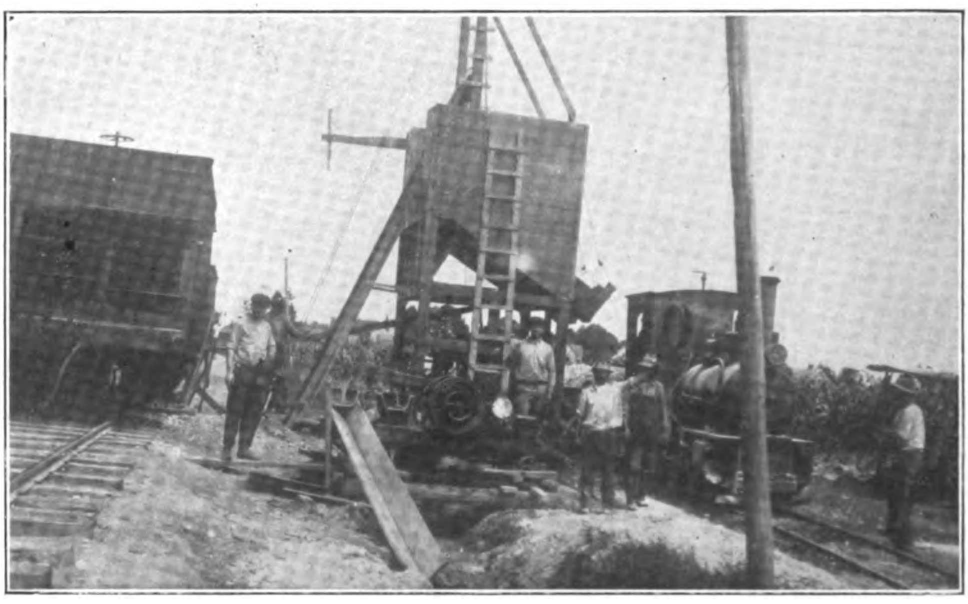
These economies are regarded as so essential that large business interests are not only willing to pay liberally for the services of expert economizers, but are constantly endeavoring to perfect the systems they employ. While system may be regarded by many as referring essentially to record, or to administration, obviously facilities must be considered as equally important, for the best results are obtainable through the utilization of organization and equipment.

To illustrate this, one may state that when motor vehicles replace animal conveyances the owner realizes that operating record is necessary to insure the most efficient use of the machines, and that neither records nor careful operation will obtain the greatest measure of economy unless there are equally improved facilities for loading and unloading.

Handling and hauling material used for special highway construction, in building operations, such as crushed stone, gravel, sand and slag, in coal yards, on piers, or in railroad yards, the Eclipse Unloader, built by Galion Iron Works and Manufacturing Company, Galion, O., is an example of what has been specially developed to meet a diversity of needs, and which can be used for temporary or permanent needs, although constructed to be portable.

The special value of this apparatus is that it affords a means of economizing the time of motor trucks used by construction companies or dealers in coal, and the investment it represents is comparatively small. Being portable, it can be removed from one work to another, and the expense of removal is really very small. Not only this, the owner has always what is equal to permanent construction, save in capacity, and with this he can undertake work or contracts at prices less than were he compelled to erect special unloading apparatus.

Quick loading of trucks is practical with sufficient men to shovel and trim the loads, but labor costs money and to minimize the time and labor of unloading railroad cars the Eclipse portable unloader was developed. This is constructed in 15 and 50-ton capacities and both are alike save in proportions. These are designed to be located beside a small stone crusher, beside a railroad sliding, in a gravel or sand pit, or in a coal yard. When set up the unloader has all the qualities of permanent construction, but it can be partially disassembled and removed by highway, either by animals or truck or tractor, and again located, at a very small cost. When operated it has a very large economical value because it is attended by one man, although the trimming of the load of the car may require a man or two.



Eclipse Portable Unloader Placed Between Railroad Siding and Industrial Railway to Economically Handle Crushed Stone by McNerney Construction Company, Canton, Penn.

The unloader is really an elevator with bin capacity of either 15 or 50 tons, and it can best be used with any type of bottom discharging railroad car. Most railroads have gondolas of from 40 to 50 tons load capacity that are designed for the transportation of stone, gravel, sand, coal, etc., having hopper bottoms in which the loads will concentrate by gravity and from which the material can be unloaded very rapidly. Older type cars are frequently fitted with bottom slides so that they can be similarly unloaded by gravity with minimum trimming. The unloader is located at a siding and the cars are moved so that the hoppers or slides are over a chute placed in the track through which the load is discharged into a bucket in a pit be-

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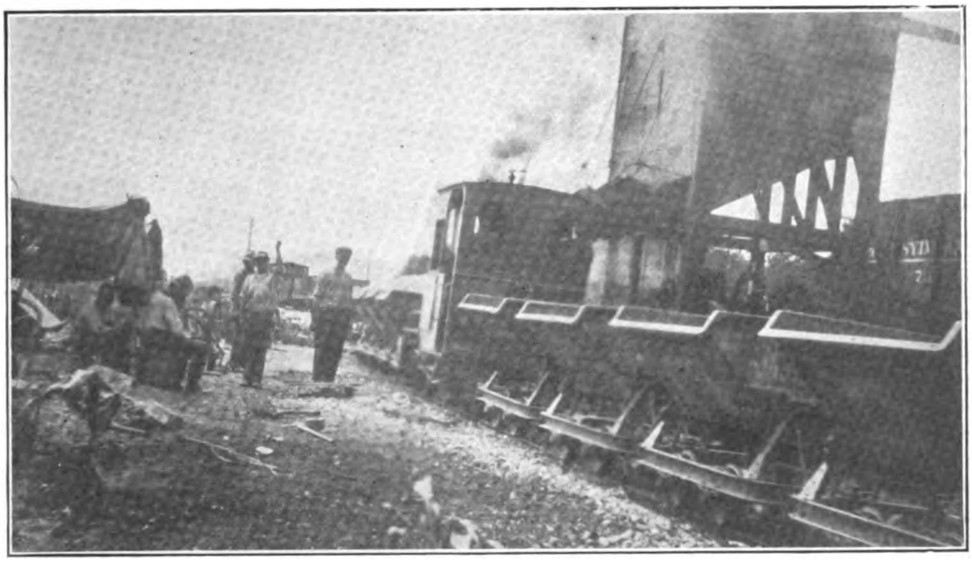
tween the elevator and the track. The loaded bucket is hoisted on an inclined track and emptied at the top of the track into a hopper bin, from which it is discharged by gravity through chutes into the carts or trucks that are driven beside the elevator, three chutes so distributing the loads in the vehicles that trimming is unnecessary.

The following description is of the 15-ton unloader. The frame timber is six inches square, and the frame is eight feet length and seven feet width, built on side sills that are eight feet six inches length. Including the sills the frame is nine feet eight inches height. There are four corner posts and a centre post at what will be termed the right end. From the back side of the frame to the front the floor slopes four feet in the full width of seven feet, the front line of the floor being five feet eight inches above the bottom of the sills. This frame is mounted on two trucks or axles on which are four wheels with steel spokes and wide rims. The frame when mounted is 24 inches above the ground. At the four corners are six-inch timbers that are hinged so they can be folded against the sills. These posts are 22 inches length and when lowered and upright they are secured by heavy iron braces. When the elevator is set up these posts are placed on railroad ties or timber to afford a secure foundation.



Loading an Industrial Railway Train from an Eclipse Portable Unloader Set Up Beside a Railroad Siding to Unload Crushed Stone from Cars.

At the height of the lower edge of the inclined floor are transverse six-inch timbers that brace the frame. The front and two sides of the hopper above the inclined floor are planked and braced. At the top of the frame, side and end sections, each 48 inches height, are mounted on heavy hinges on which they may be raised to form the upper part of the hopper, or lowered when the unloader is to be removed. When set up these sides are securely bolted by angle irons so that the entire construction is rigid. At the back of the elevator the tower is placed on the upper timber of the frame. The tower is two six-inch timbers, 14 feet three inches length, three feet four inches apart, with a cap piece of the same size timber four feet nine inches length. The lower ends of the tower timbers are bolted to the frame, and from the corners of the front side braces extend diagonally to the tower. These braces are secured at the lower ends to a six-inch transverse timber that carries a hoisting pulley. Steel rods brace the tower frame at either side. At the right end is a small platform at the height of the top of the upper section of the bin, on which a man can stand and do whatever work may be necessary on the hoisting gear. Usually a series of wood strips nailed on the frame and the tower form a ladder to reach the top of the elevator.

The bin or elevator is located 13 feet from the rail of a track. Eighteen inches from the centre of the rail and five feet seven inches from the back of the elevator a pit is dug that is six feet width and five feet six inches length, the centre of which is directly in line with the centre line of the elevator tower. The pit is seven feet depth. In this pit is placed wooden side and end sections that form a box six feet by four feet six inches, and a floor. Beginning at the pit and extending to the line of the second rail of the track an inclined channel is excavated that is 41 inches lower at the pit than at the track. Into this a steel chute is placed and the earth tamped to make it immovable, the ties being spread apart 25 inches so as to insure a clear fall into the chute from the surface of the track. The chute is 22 inches width and is brought through the side of the box. Over the outlet end of the chute is placed a frame for raising and lowering the end gate.

A track, or run, of heavy timber, is built to extend from the bottom of the box in the pit to a point three feet above the top of the elevator bin. The length of the track is 26 feet three inches, and from the ground to the top of the tower is 25 feet six inches. A steel bucket that will hold three-quarters of a cubic yard, or about one ton, is used for elevating the material. At the top of the track the bucket contacts with a stop that causes it to turn and the contents is dumped into the bin.

The track is placed in the box in the pit with the upper end bolted to the tower of the elevator so that it forms a brace for the bin and tower and at such an inclination that when the bucket is lowered it will clear the chute from beneath the railroad track about an inch. The foot of the track is firmly chocked. A wire cable is secured and clamped to the cross piece of the tower frame and passed through the sheave on the bail of the bucket and carried through a pulley suspended from the cross piece of the tower, thence

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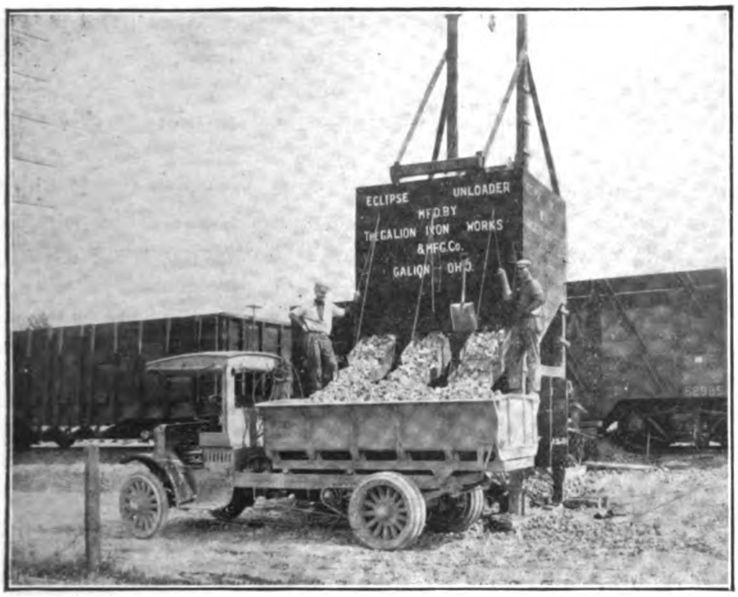


Loading a Motor Truck with Crushed Stone by Gravity Discharge Through Three Chutes at a Railroad Spur Track.

through another pulley at the top of the frame on the front side of the bin, and through an iron pipe placed in the bin at an angle from the front to the rear, to the hoisting drum. This hoist is operated by a six-horse-power water cooled gasoline engine that is located beneath the bin, and this hoist is fitted with a clutch and release. A long wooden lever is carried from the lever operating the hoist to a point close to the railroad track, so that it may be readily reached by an operator who can from the same position operate the end gate of the chute beneath the track. The engine can be enclosed when necessary. The motor is operated constantly when the elevator is used.

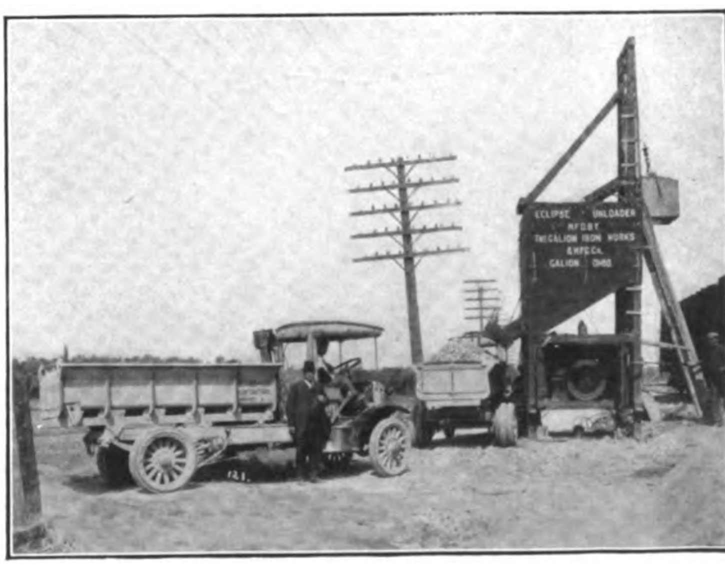
A railroad car is located with the discharge hopper directly above the chute in the track. When the work is begun the hopper is opened and the contents of the car falls by gravity into the chute, and thence into the bucket in the pit. The flow of the material is started when the bucket is at the foot of the track, and stopped when it is filled, by raising and lowering the chute end gate by a lever, the operator observing the condition of the bucket in the pit. The hoist is operated by a forward and backward movement of the long wooden horizontal lever that is connected with the upright lever of the hoisting apparatus, which engages and releases a clutch. The bucket descends by gravity after dumping.

The inclined floor of the bin carries the material by gravity toward the front, in which are three openings 20¼ inches width and 14 inches height, from which three chutes extend two feet with extensions that may be raised or lowered, and which serve as end gates. These are operated by cables and counterweights. The railroad car can be moved, if it has bottom slides or more than one discharge hopper, to bring the slides or hoppers above the chute in the track, or the load may be trimmed to facilitate discharging. The unloading can be done at a rate of from five to 10 carloads of from 40 to 50 tons capacity, each in a 10-hour work day, a single man operating the unloader. Once the motor is started the operator's work is principally handling the control levers and observing the condition of the bucket in the pit, releasing the clutch when the bucket is emptied. Aside from filling the water, fuel and oil tanks of the motor, and lubricating it and the hoist, oiling the sheaves occasionally and greasing the track on which the bucket is raised and lowered, no attention is necessary.

The loading of the carts and wagons is done by the drivers without delay or assistance. The vehicles are driven beside the unloader, the three chutes are lowered and the contents of the bin discharged into them until a load is obtained. The balanced chutes can be handled almost instantly and no trimming is necessary. The elevator will handle from 250 to 500 tons of material a day, the volume depending upon conditions, and claim is made by the company that the transfer from railroad car to vehicle will cost less than two cents a yard. The unloader will handle any material that can be discharged through the regular hopper-bottom railroad cars, and special equipment is built to handle bituminous coal.

With the unloader the fixed charges for service are the interest on the investment, insurance, if this item is carried, and depreciation. The operating cost include the wages of a capable, intelligent man, fuel and lubricant expense, and with such slight repairs as might be necessary to maintain the cable and hoisting apparatus, with the charge for removal and erection proportioned for each day the job continues. When not in use the fixed charges only must be considered. But to obtain precise figures these could be divided pro rata with the work.

The cost of handling material from cars is estimated to average 15 cents a cubic yard, this being principally wages, but this does not include the loss of



Trucks Can Be Loaded Without Trimming and Without Waiting, the Driver of Each Machine Doing All the Work.

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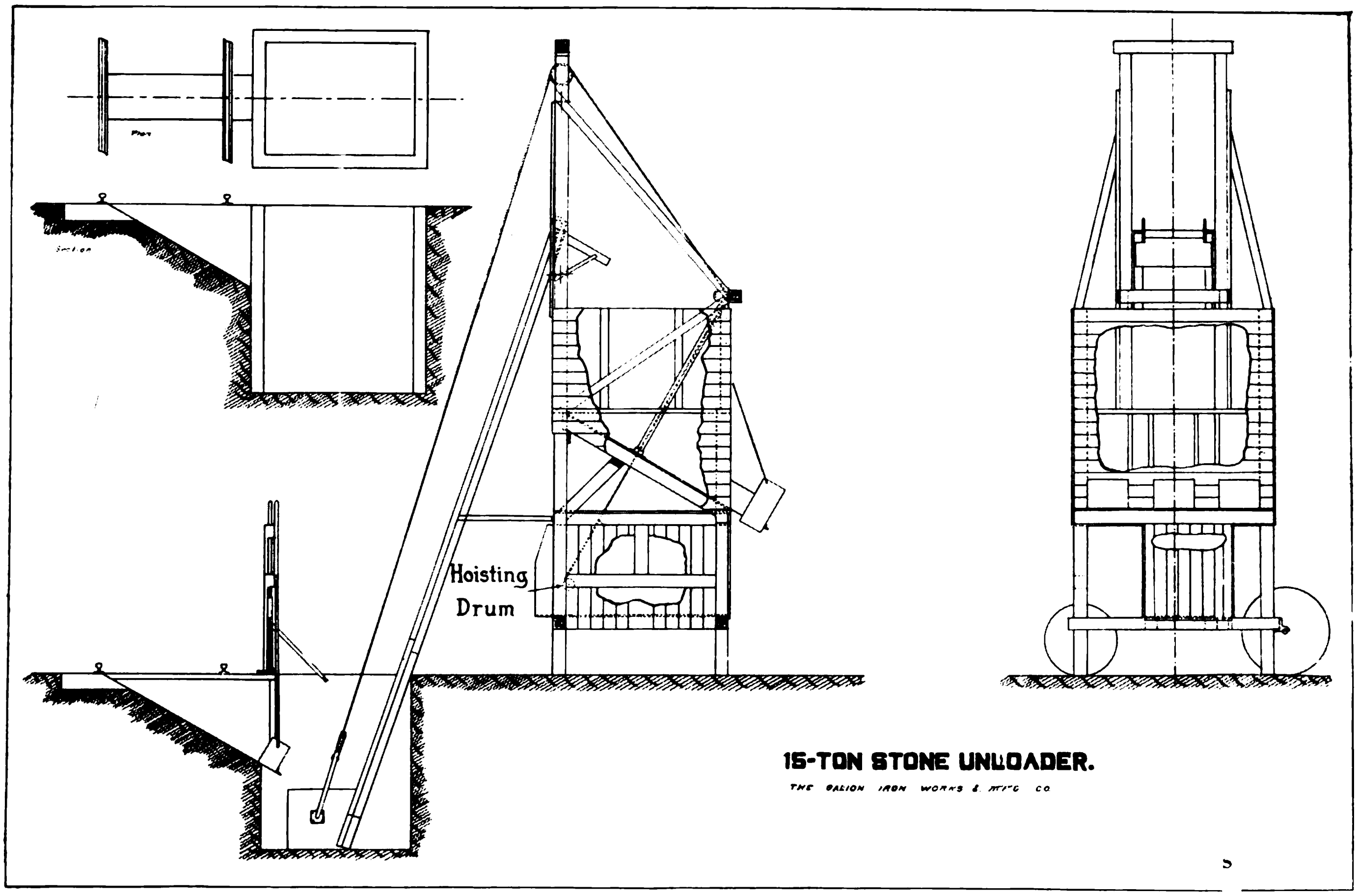
time of the carts or men driving them during the periods of loading. The cost of lost time, if charged to handling, would probably double the figure stated. With the unloader a five-ton truck can be loaded in two minutes, and with cars in readiness it can be worked to capacity. The greater the tonnage handled the lower the cost a yard. The elevator of 50 tons capacity is constructed and erected in precisely the manner stated.

The removal from one location to another is extremely simple. The track is hoisted from the pit by the cable. The tower is demounted and lowered. The angle irons securing the corners of the upper section of the bin are removed and the side sections lowered. The truck is replaced under the right end of the supporting frame (this being the two wheels, axle, turntable and pole, evener and whiffletrees), and the iron braces holding the end posts and legs are removed. The legs are raised on their hinges, and then the elevator can be hauled by a truck, a horse team or road roller. The time of dismantling is but a few hours, and the haulage time is dependent upon the distance to be traversed. Wherever set up, the pit must be dug, and when leaving this must be filled, especially if beside a railroad track. The construction of the unloader is such that it will afford service for years, and in winter the lower portion can be housed to shelter the engine and hoist.

The use of the unloader in connection with an industrial railroad is practical and economical, and accompanying illustrations show one owned by the McNerney Construction Company, Canton, Penn., where crushed stone is taken from railroad cars and transferred to the smaller dump cars of the industrial railroad. This concern originally utilized it for unloading railroad cars and loading wagons and trucks, and found that it saved all the time that had been lost by vehicles waiting for freights. It then used it with the industrial railroad with equal success. By regulating the work and establishing a headway between vehicles and trains the tonnage hauled was greatly increased and the cost much reduced, this being a dual economy.

ASTORIA MUST PAY FOR ENGINE.

Because the city of Astoria, Ore., refused to pay for a LaFrance motor fire engine that the American-LaFrance Fire Engine Company, Elmira, N. Y., had constructed to order and shipped, and which had been tested by the city authorities, suit was entered, and recently the United States court for Oregon handed down its decision ordering the city to pay the cost of the engine and the costs of the suit. While it was admitted that the city council had passed a motion to purchase a fire engine and authorized a committee to deal with the LaFrance Company, the defense contended that no written contract was made by city "ordinance", and "signed by the auditor and police judge, or some other person authorized on behalf of the city".



Front and Side Elevation of a 15-Ton Eclipse Portable Unloader, Showing the General Construction, the Track from the Elevator Into the Unloading Pit and the Chute Into Which the Car Load Is Discharged.

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DEATH OF H. WARD LEONARD.

Henry Ward Leonard, founder of the plant at Bronxville, N. Y., that bears his name, and inventor and electrical engineer of international reputation, suddenly succumbed to an attack of apoplexy while attending an entertainment given at the Hotel Astor, New York City, Feb. 18, by the American Institute of Electrical Engineers, of which he was a member. Mr. Leonard was 54 years of age.

Born in Cincinnati, O., Feb. 8, 1861, Mr. Leonard as a youth became associated with Thomas A. Edison in the latter's central system work. He began the manufacture of automobiles in 1901 at Bronxville, his first car being first known as the Knickerbocker, and later as the Ward-Leonard. It was an entrant in two famous runs of 1902, the Long Island endurance contest and the New York to Boston run. In the next year Mr. Leonard abandoned manufacturing, and in 1909 produced an electric lighting system for automobiles which was soon followed by several other inventions applicable to motor vehicles. Among others of his inventions was mechanism for battleship turrets and ammunition hoists.

MAINE ROAD COMMISSION IN PERIL.

A bill intended to abolish the Maine highway commission, and providing that state funds for road improvement shall be handled by other methods, has been introduced into the state senate. If passed, the bill is said to have the practical effect of repealing the road law of 1913, which has been said to have meant much for Maine.

Another bill before the lower branch of the house takes away state aid from cities and towns whose valuation is above $4,000,000. Aid for towns and cities under that valuation is placed upon a graduated schedule as follows: For a valuation of $200,000 or less, $3 to every $1 appropriated by the town: for valuation between $1,000,000 and $1,200,000, $1.25 for $1 appropriated; $1,200,000 to $1,400,000, $1.15; $2,000,000 to $3,000,000, 75 cents; $3,000,000 to $4,000,000, 50 cents for $1 appropriated by the town.

AUTOMOBILE CONVERTED INTO SAW MILL.

By removing the rear seat of a five-seated touring car and placing a saw arbor there, David Pero, Bath, Me., has contrived a portable saw mill with which he states he can saw from 15 to 16 cords of wood a day. Power is obtained by connecting a band with one of the rear wheels.

To start definite action toward a national association, a meeting to be held at Detroit, Mich., March 19, has been announced by the Motor Truck Club of America, in its call to makers of commercial automobiles.

RUBBER SHORTAGE POSSIBLE.

If American Supply Through England Is Cut Off, Industry May Suffer.

F. A. Seiberling, president of the Goodyear Tire and Rubber Company, Akron, O., has returned from a two months' investigation of the rubber situation in the war area of Europe. With other members of the Rubber Club of America, Mr. Seiberling went to Europe to raise England's embargo against the shipment of crude rubber after the club's efforts through the State Department at Washington had proved unsuccessful. Mr. Seiberling explains the situation as follows:

"Up to the time that I left England, on the Lusitania, the English people were not disposed to take Germany's blockade declaration seriously. There can be no doubt, however, if the blockade plan is carried out, that there will be some interference with shipping to the United States—and rubber supplies for America will come in for their share of disturbance. If our supplies through England are actually cut off, we shall do as we did before, when the Emden was creating havoc with English shipping in the Indian ocean—get our supplies by way of the Pacific ocean.

"So long as England does not reimpose an embargo against the shipment of crude rubber from her possessions to the United States, we do not look for a stoppage of the American supply. When I left for England, early in January, the embargo was still on, and the outlook seemed dark for the American rubber industry. The Rubber Club of America, through the State Department, had failed to move England from her determination, and had given up. However, the Rubber Club of London, composed largely of rubber brokers, kept on working and was successful. Before the Lusitania, carrying American rubber men, reached the other side, the embargo was off and there was nothing for us to do except to attend to the details for our respective companies".

Speaking of the war's relation to the United States generally, Mr. Seiberling added: "America must retain her neutrality. All Americans should stand united on that point, no matter what their political beliefs may be. And the closer one views the conflict, the greater the sense of horror. It would be an unspeakable calamity for the United States to become involved in the conflict that is devastating Europe".

AUTOCAR ELECTS OFFICERS.

The following officers were chosen for the Autocar Company, Ardmore, Penn., at the last annual meeting: David S. Ludlum, president; Walter W. Norton, vice president and production manager; John S. Clarke, vice president; Edwin A. Fitts, secretary and treasurer; Frank C. Levin, assistant secretary and treasurer.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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ADVERTISING RATES.
Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, February 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

TRACTORS AND TRAILER TRAINS.

Motor road haulage economy is best obtained from capacity loads and long hauls, for which trucks serve every requirement, or by extremely large loads that may be handled quickly, a service for which tractors and trailers can be utilized to good advantage. A tractor and a semi or two-wheeled trailer will carry but a single large load. The tractor and trailers will haul several loads, or considerably greater tonnage, but control of the train units has not been entirely satisfactory; in fact such trains are impracticable in traffic.

Tractor trains are necessarily slow because of the large loads, and thus far their uses have been limited. There is no doubt, however, that these could be utilized for transportation on routes radiating from commercial centres, where much of the haulage could be done at night, and where freights could be carried in either direction. In agricultural communities and in sections where railroad facilities are limited or inadequate, or where transportation rates are excessive, there are apparently very promising opportunities for business that can be profitably developed.

COST OF SELLING TRUCKS.

Selling expense is one of the largest items included in the cost of a motor truck. Where five salesmen interest a man and one of them sells a single truck the cost to each manufacturer may be approximately the same. Only one makes a profit. The selling cost is not regarded as a loss by those who made no sale, but the price of a vehicle must be sufficient to pay for the work of the selling organization and yield a satisfactory return.

Concentration of effort is undoubtedly the more productive, and endeavor systematically directed will afford more substantial returns than unsystematized selling. A national market is admirable to theorize, but it is very costly to exploit, and cannot be made as profitable as the sectional market. This applies especially to New England, where more motor vehicles are owned in proportion to the population than anywhere else in the world. New England and the adjacent states are a sufficiently large market to interest any manufacturer, no matter how large a number of vehicles he may produce, and the selling opportunities are greater because of the commercial and industrial needs and the extreme cost of railroad transportation.

BUSINESS ECONOMIES DEMAND TRUCKS.

Commercial and industrial conditions have impelled business men to regard the possibilities of transportation with extreme care, and as physical limitations of animals cannot be exceeded without sacrifice, as the expense of horse food has greatly increased with no increase of work, and as traffic speed is a material factor in communities of proportions, the motor vehicle is believed to be the logical conveyance. Many are convinced that machines could be best utilized, but hesitate to purchase because of the assumption that animal equipment would be sacrificed and doubt as to the efficiency of their own administration.

The wise purchaser of motor vehicles first understands his own needs, selects the machine that will seemingly best serve him, and then makes any changes that may be necessary to utilize it. There is no mystery in obtaining high efficiency with motor vehicles. The principal factor is careful study of a subject that was assumed to be simple, and which the most progressive minds have found can be best dealt with by organization and system, and by utilizing exact record.

ENGINE STARTERS FOR TRUCKS.

Whether engine starters are desirable equipment for motor trucks is a subject on which engineers and manufacturers are not agreed, some believing that the additional complications and cost more than offset the advantages of lessened fuel and lubricant consumption, although little attention has been given to the decreased wear of the motor. When machines are used in heavy traffic, as in many of the larger cities, engines are seldom stopped because of the need for starting quickly at signal, and vehicle stops and starts are very frequent, necessitating idle running of the motors. The experience with engine starters in motor truck service is thus far limited, and their use is worthy especial study.

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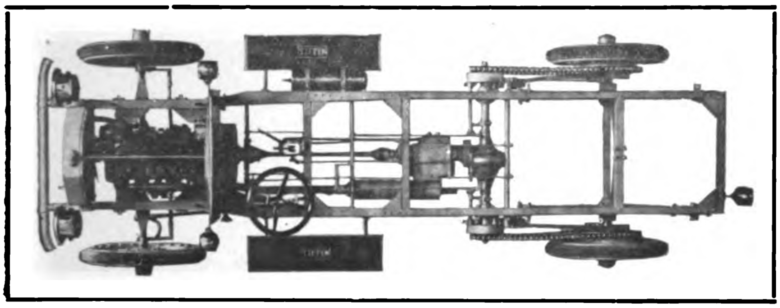
THREE MODELS OF TIFFIN TRUCKS.

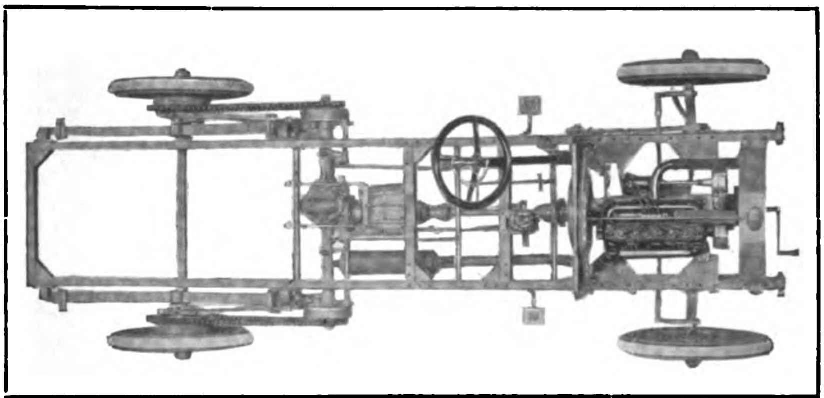
THREE types or sizes of motor trucks are built by the Tiffin Wagon Company, Tiffin, O., these having capacities of 1500, 2000 and 4000 pounds, which



Plan View of the Model G Tiffin Truck, Capacity 2000 Pounds.

are designated as models A, G and M respectively. This concern has carefully developed these types to supply an increasing demand for high-class vehicles suited for the majority of haulage requirements, and the machines have been designed to have extreme endurance as well as be very economical of general operating cost.

The chassis have practically the same design aside from the power plants, differing chiefly in proportions of parts. The components of which the machines are constructed are products of the best known manufacturers of the industry, and are regarded as standards. No innovations have been made, the engineers deciding to follow principles and constructions that have been proven to be enduring and in every way equal to requirements, and to utilize materials that would be recognized as having quality and dependability. By this is meant that there is nothing experimental entering into the design or construction of the trucks, and so large factors of safety have been provided that service is assured.

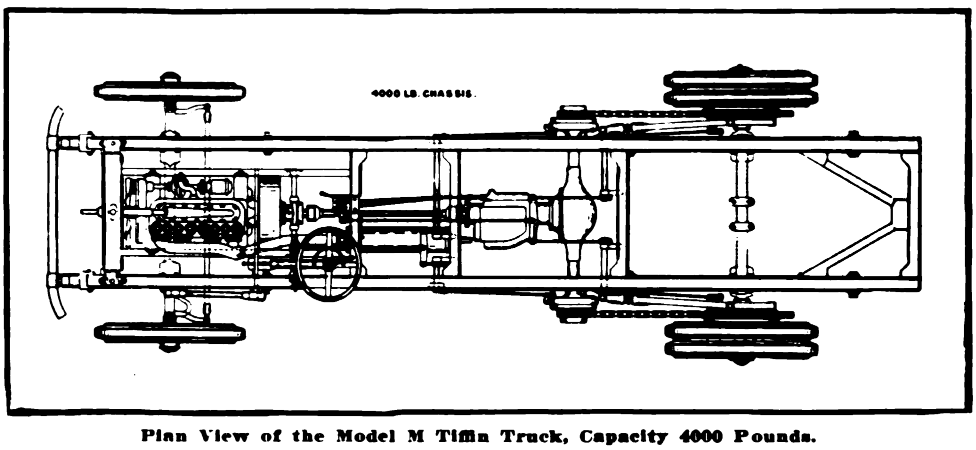


Plan View of the Model A Tiffin Truck, Capacity 1500 Pounds.

The generally accepted power transmission system with motor, clutch and gearset assembled with the jackshaft has been adopted with the drive by sprockets and chains to the rear wheels. Much attention has been given to distribution of weight and to obtain large loading space. All of the machines are built with the motors under hoods, and the driver's seat behind the engine, this giving the accessibility necessary to economize labor and time in operating, care and adjustments.

The motor of model A is a Buda, a water cooled, four-cycle, vertical L head type, with the cylinders cast en bloc, having bore of 3¾ inches and stroke of 4½ inches, which is rated by the S. A. E. formula at 22.5 horsepower, and is claimed by the builder to develop 30 horsepower at 1500 revolutions a minute. The block is cast from fine gray iron with very large water jackets integral to insure free passage of water and efficient cooling, the water chamber being covered with a cover plate and outlet manifold retained by cap screws. The pistons are the same material and are fitted with three piston rings and three oil grooves. The cylinder block is tested by water pressure, bored, aged, reamed and ground, and the pistons are carefully fitted.

The crank case is aluminum alloy, cast with the supporting arms integral, and is in two sections, the upper carrying the three mains bearings, the centre bearing being mounted in a vertical transverse web, and the lower section is the base ot the crank chamber, a horizontal web containing the oil troughs, below which is the oil reservoir. This section can be removed readily for work on the engine bearings. The crankshaft is a special alloy steel drop forging, with the flange to which the flywheel is bolted forged integral, that is heat-treated and carefully finished. It is 1¾ inches diameter at the bearings, the forward bearing being 3½ inches and the rear bearing 4½ inches length. The connecting rods are I section steel drop forgings, with caps retained by nickel steel bolts.



Plan View of the Model M Tiffin Truck, Capacity 4000 Pounds.

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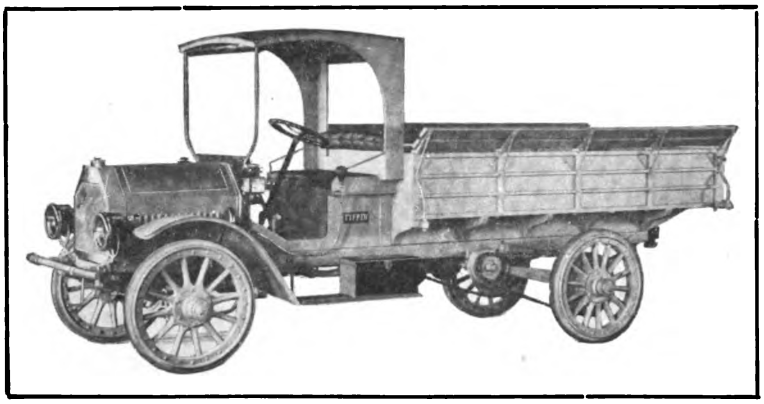
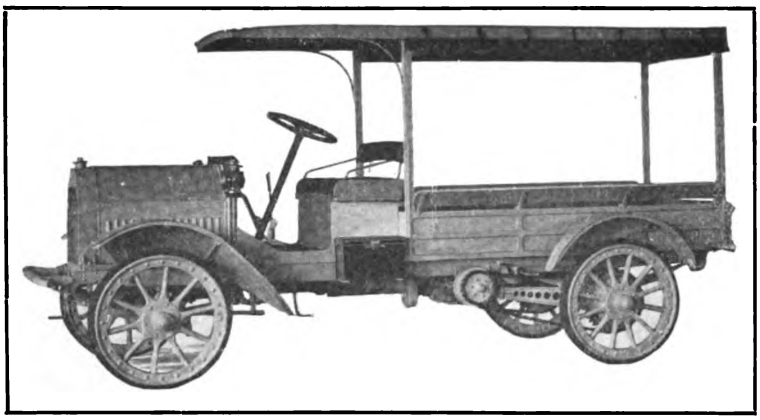


Model G Tiffin Chassis Equipped with Large Express Body and Cab.

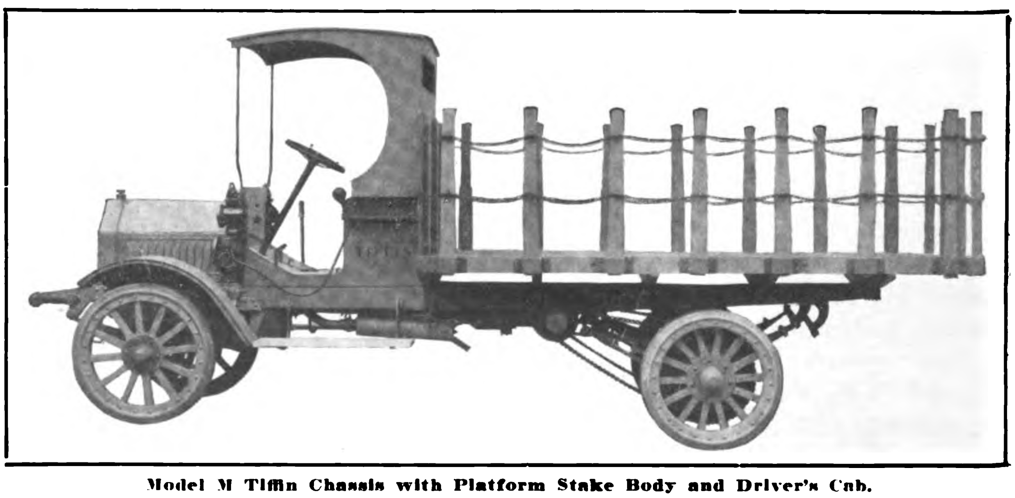
The wristpins are case hardened steel tube, fixed in the piston bosses. The main and connecting rod bearings are nickel babbitt, and the wristpin bearings are phosphor bronze.

The camshaft is a steel drop forging with the cams and a flange to which the timing gear is bolted integral. This is heat treated and hardened and ground. The three bearings are phosphor bronze. The timing gears are helical cut to insure noiseless operation. The valve ports are large and the valves are made with nickel steel heads electrically welded to steel stems. These operate in long guides. The valve tappets are a mushroom type, with adjusting screws, and are fitted in heavy guides. The valve stems, tappets, guides and springs are enclosed by cover plates.



Model A Tiffin Chassis with Four-Post Standard Canopy Top Body.

The motor is cooled by a thermo-syphon circulation of water through it and a vertical tube radiator mounted on coiled springs, there being large outlet and inlet manifolds. Radiation is promoted by a fan installed on a ball bearing on an adjustable bracket at the front of the engine case, which is driven by a flat belt by a pulley on the extension of the crankshaft. Lubrication is by a combination force feed and splash system. The oil is drawn from the reservoir by a plunger pump driven from the camshaft and forced through tube to the main bearings and the timing gears, the excess draining into the oil troughs, from which the splash lubricates the cylinders, pistons, camshaft and tappets, the overflow from these draining back into the reservoir. The oil passes through a sight glass on the outside of the engine case, so that the driver may learn at a glance if the supply of oil is sufficient. The oil pump and strainer may be removed from the outside of the case. Leakage of lubricant is prevented by oil deflectors for the front and rear main bearings and magneto shaft bearing. The fuel intake and the exhaust manifold are large and well designed to insure free passage of the gasses. An automatic float feed type of carburetor is fitted.



Model M Tiffin Chassis with Platform Stake Body and Driver's Cab.

The engine for model G is a Continental, a water cooled, four-cycle, L head type, with the cylinders cast en bloc, having bore of $3\frac{3}{4}$ inches and stroke of $5\frac{1}{4}$ inches, and a rating of 22.5 horsepower by the S. A. E. formula. This is rated by the builder as 30 horsepower, and 38 horsepower is claimed for it. The motor for model M is $4\frac{1}{8}$ inches bore and $5\frac{1}{4}$ inches stroke, for which the maker claims 42 horsepower.

In the bore-stroke dimensions the engines differ, but in all other constructional details they are alike. For this reason one description will suffice for both. The cylinder block is cast from a superior quality of gray iron with integral water jackets, the water jacket head being a large, separate plate, this insuring the clearing of the water passages and ample water above the combustion chambers to efficiently cool the motor. This head is formed to direct the water to the outlet manifold. It is retained by a series of cap screws. The cylinders are tested by water pressure, are rough bored, aged, reamed and ground to size. The pistons are cast from the same material as the cylinders. These are of unusual length. They are turned with

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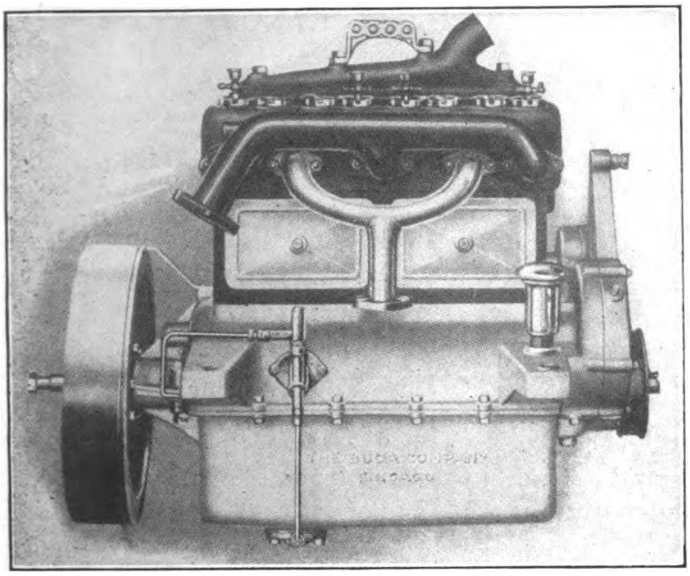


Right Side of Continental Motor Utilized with the Model G and M Chassis.

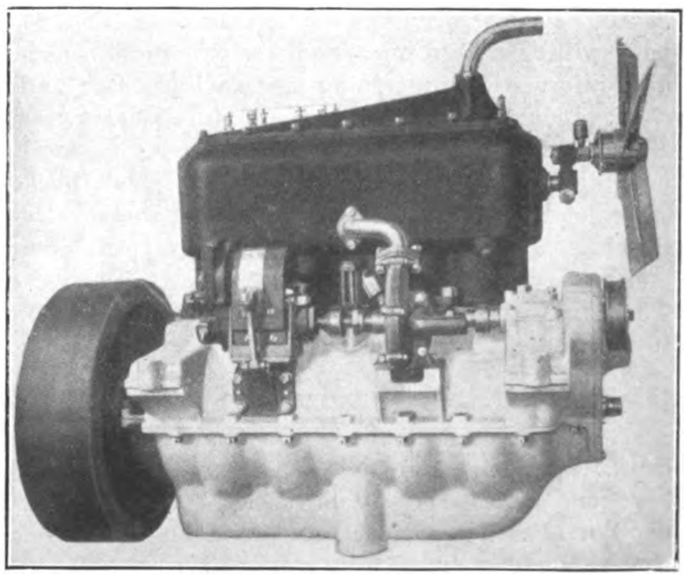
four channels for eccentric split rings and with five oil grooves. Much care is taken to insure the alignment of the wristpin holes in the bosses. The rings are carefully made and specially machined to relieve casting strains.

The crank case is cast from a nickel aluminum alloy in two sections, the upper half carrying all the bearings. The top part of the case has a vertical transverse web for mounting the centre main bearings, and the lower portion is divided by a horizontal transverse web in which are the oil pockets for the splash oiling system, and below this is the oil reservoir. The lower section is removable for work on the bearings. The crankshaft is a special steel drop forging with flanges to take end thrust, with main and crankpin bearings 1¾ inches diameter, the main bearings being 2¾, three and four inches length respectively from front to rear, with connecting rod bearings 2½ inches length. The camshaft is a steel drop forging with the cams integral that is turned, and after the cams are rough machined is annealed and heat treated, and then finished ground. The bearings of the crankshaft, camshaft and connecting rods are high-grade nickel babbitt, the crankshaft and connecting rod bearings being held by brass retaining screws, and the latter bearings being fitted with shims for adjustment. There are three camshaft bearings. The connecting rod caps are secured by nickel steel bolts. The wristpins are clamped in the small ends of the connecting rods and oscillate in bearings in the piston bosses. The camshaft may be removed quickly by taking off the cover of the timing gear case.

The timing gears are helical cut, much care being taken to obtain accurate maintenance of gear centres, and are practically noiseless in operation. They are housed by an extension at the forward end of the crank case. The valve ports are two inches diameter and the interchangeable valves have nickel steel heads electrically welded to carbon steel stems. The ends of the valve stems are hardened. The valves operate in long guides. The mushroom type tappets are large and are mounted in guides mounted in the base flange. They have the usual screw and nut adjustment.

The motor is lubricated by a combination force feed and splash system, the oil being drawn from the reservoir through a strainer by plunger pumps driven by an eccentric on the camshaft and forced through tube to the rear main bearing and the timing gears, the excess draining to the crank case pits, where splash distribution carries oil to the cylinder and piston walls, the wristpin bearings, the connecting rod, centre main and camshaft bearings, and the valve tappets. The motor is cooled by a circulation of water through the engine block and a vertical tube radiator, which is forced by a centrifugal pump of the double bearing type that has extra large bearings. A fan mounted on a ball bearing bracket on the forward end of the block is adjustable by an eccentric, and is driven by a flat belt from a pulley on an extension of the camshaft. With these two types an automatic float feed carburetor is used.

From this point on the description of the one will apply to all models. The ignition is by Bosch high-tension magneto. The clutch is a leather-faced Hartford construction fitted with expanding springs. This is supported from a frame cross member and the driving shaft is coupled with the clutch shaft and the main shaft of the gearset by a universal joint at either end. The gearset is a selective sliding type with three forward speed ratios and reverse, assembled with the jackshaft, which unit is supported by a frame cross member and heavy steel hangers. The shafts and gears are heat treated nickel steel, the gears having wide faces, and the shafts are mounted on generous roller bearings. The driving thrust is taken by radius rods rotating on collars on the rear axles and pivoted vertically at the coupling to the jackshaft. The frames are pressed steel channels, that of model G being "necked" forward, with strong cross members and heavy gusset plates, which are suspended on semi-elliptic springs.



The Valve Side of the Buda Motor Used with Model A Chassis.

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models G and M having cross jack springs.

The front axles are all I section drop forged steel, and the rear axles rectangular steel drop forgings, those of models A and G being Sheldon productions and those of model M being Timken made. The axles of model A are equipped with ball bearings, and the axles of models G and M are fitted with annular ball or roller bearings as desired by the purchaser. The wheelbase of model A is 112 inches, of model G 128 inches, and of model M 140 inches, and the tread of the first two is 56 inches and of the last mentioned 60 inches. The wheels of model A are fitted with 34 by three-inch tires, those of model G with 36 by 3½-inch tires forward and 36 by four inches rear, and those of model M with 36 by four-inch forward and 36 by 3½-inch dual forward.

The steering gear is an irreversible screw and nut type with the column at the left side, the control being by the usual foot pedals for the clutch and service brake, with hand levers for the gear shift and the emergency brake at the centre of the footboard. The ignition and the throttle levers of the friction type are on the steering wheel, and the fuel supply is regulated by a foot accelerator. The service brakes are external contracting on drums on the jackshafts, the drums of all models being 10 inches diameter and two inches face, the internal expanding brakes operate within drums 12 inches diameter and 2½ inches face on the model A chassis, drums 14 inches diameter and three inches face on the model G chassis, and 16 inches diameter and 3½ inches face on the model M chassis. All the brake bands or shoes are lined or faced with Raybestos, and all brakes are equalized. The chassis are equipped with the usual tool box and tool kit, jack, horn, oil dash and tail lamps and bumper.

The company builds a very large number of wagons and special municipal equipments and is prepared to build special bodies if the standard types, of which a considerable number is produced, do not meet requirements. Any body can be built. Tiffin trucks in considerable numbers are in service and they have invariably given excellent satisfaction. The company will be glad to refer inquirers to owners who can give information concerning the machines first hand.

The company has for years produced heavy vehicles, municipal and sanitary equipment, automatic flushing machines, dumping wagons, steel bucket street cleaning and garbage carts, specializing street flushing apparatus, entirely motor equipped, of the constant pressure type, with 900-gallon tank capacity. The company will supply detail information relative to these apparatuses at request.

A quarterly dividend on its common stock of 3 per cent., was declared by the Goodyear Tire and Rubber Company, Akron, O., in place of its annual dividend of 12, which course is said to be an accommodation to small stockholders. March 1 was set as the day of disbursement to stockholders of record Feb. 20.

WILLYS UTILITY CHANGES MADE.

In addition to the announcement of John N. Willys' withdrawal from the motor truck industry, contained in the preceding issue of Motor Truck, further information is given to the effect that the Willys Utility truck will be known in the future as the Garford Utility, which will be manufactured by the Garford Motor Truck Company, Inc., Lima, O., of which E. A. Williams, Jr., is president. This company will manufacture the Garford truck, which retains its old name, as well as trucks varying in size from the 1500-pound Garford Utility through the regular Garford line of 1½, two, three, four, five and six-ton models, ranging from the smallest practical size to the largest practical motor truck of the Mogul (Garford) pattern.

R. E. Taylor, who was general sales manager of the R. & L. Company, formerly eastern distributor of Garford and Willys Utility trucks, has been appointed wholesale and retail distributor for the company in New England, New York and New Jersey, with offices in New York City. Under the new regime the day and night service stations in New York City, Brooklyn, Newark and Boston will be maintained.

GOODYEAR TIRE APPLYING PRESSES.

The Goodyear Tire and Rubber Company, Akron, O., has bought 50 150-ton tire applying presses, whose value runs into tens of thousands of dollars, for the use of its branches and certain dealers throughout the country. They are to be used in the application of the Goodyear S. V. tire, as the company calls its new pressed-on tire, which by the elimination of the use of bands, bolts, nuts, etc., is an equipment that appeals to users of solid truck tires who desire simplicity, lightness and strength. Statement is made that the number of presses will be increased in the near future.

BIG REPUBLIC TRUCK ORDER.

Under contract to begin delivery on March 15, the Republic Truck Company, Alma, Mich., is constructing 300 Republic trucks for use by the British army, the order having been placed through the Anglo-American Export Company, London, England. All the trucks are to be completed and shipped during 1915. In addition, the company has also received an order for eight of its trucks from the Chicago Examiner, Chicago, Ill.

INCREASES PLANT EQUIPMENT.

To meet the requirements of its large increase of business during the next half year, the Warner Gear Company, Muncie, Ind., is stated to have added about $60,000 worth of new equipment. This production will be in charge of Harry Orr, formerly of the American Locomotive Works, Providence, R. I., who assumed charge on March 1, as production manager.

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POWER WAGON AND TRUCK BUILDERS

Manufacturers of Gasoline and Electric Vehicles for Highway and Industrial Service, Their Addresses and the Capacities of Machines They Are Producing Commercially.

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
A & B	American & British Mfg. Co.	Providence, R. I.								3				5				
A & R	Abendroth & Root Mfg. Co.	Newburgh, N. Y.								3		4		5				
Adams	Adams Bros. Co.	Findlay, O.				1	1½	2										
Admiral	Admiral Motor Car Co.	St. Louis, Mich.					1½											
Aetna	Aetna Motor Truck Co.	Detroit, Mich.					1½		2½									
American	American Motor Truck Co.	Detroit, Mich.				1												
American-Argo*	American Electric Car Co.	Saginaw, Mich.		½		1												
Armleder	O. Armleder Co.	Cincinnati, O.				1	1½	2										
Atlantic*	Atlantic Vehicle Co.	Newark, N. J.		½		1		2			3½			5				
Atterbury	Atterbury Motor Car Co.	Buffalo, N. Y.			¾	1		2		3				5				
Auglaize	Auglaize Motor Car Co.	New Bremen, O.			¾													
Autocar	Autocar Co.	Ardmore, Pa.					1½											
Automatic**	Automatic Transportation Co.	Buffalo, N. Y.				1		2										
Available	Available Truck Co.	Chicago, Ill.				1		2										
Avery	Avery Co.	Peoria, Ill.				1		2		3				5				
B. A. Gramm	Gramm-Bernstein Co.	Lima, O.				1		2			3½			5				
Baker*	Baker Motor Vehicle Co.	Cleveland, O.		½		1		2			3½			5				
Barker	C. L. Barker	Norwalk, Conn.				1		2										
Bauer	Bauer Machine Works Co.	Kansas City, Mo.		½	¾													
Beardsley*	Beardsley Electric Co.	Los Angeles, Cal.		½		1												
Beaver*	Beaver State Motor Co.	Portland, Ore.																
Beck	Beck & Son	Cedar Rapids, Ia.					1½		2½									
Bessemer	Bessemer Motor Truck Co.	Grove City, Pa.				1	1½	2										
Best	Durant-Dort Carriage Co.	Flint, Mich.		½														
Bingham	Bingham Mfg. Co.	West Park, O.			¾													
Blair	Blair Motor Truck Co.	Newark, O.						2		3		4		5				
Board	B. F. Board Motor Truck Co.	Alexandria, Va.																
Brasie	Brasie Motor Truck Co.	Minneapolis, Minn.	¼					2										
Brennan	Brennan Mfg. Co.	Syracuse, N. Y.																
Brockway	Brockway Motor Wagon Co.	Cortland, N. Y.			¾		1½	2										
Bucklen	H. E. Bucklen, Jr. Motor Truck Co.	Elkhart, Ind.			¾		1½		2½									
Buckwalter**	Elwell-Parker Electric Co.	Cleveland, O.																
Buffalo	Buffalo Auto-Truck & Motor Co.	Buffalo, N. Y.																
Buffalo*	Buffalo Electric Vehicle Co.	Buffalo, N. Y.				1												
Buick	Buick Motor Co.	Flint, Mich.			¾													
Bulley Tractor	Mercury Mfg. Co.	Chicago, Ill.																T.
Caldwell	Empire Axle Co.	Dunkirk, N. Y.																
Capitol*	Capitol Truck Mfg. Co.	Denver, Col.																
Carl*	Carl Electric Vehicle Co.	Toledo, O.																
Carlton	Carlton-Hill Motor Car Co.	Rutherford, N. J.																
Carroll	Carroll Motor Car Co.	Strasburg, Pa.																
Casey	F. A. Casey Co.	Billerica, Mass.		½														
Chase	Chase Motor Truck Co.	Syracuse, N. Y.			¾		1½			3								
Coleman	Coleman Carriage & Hardware Co.	Ilion, N. Y.				1		2		3								
Commerce	Commerce Motor Truck Co.	Detroit, Mich.			¾													
Connersville*	Connersville Buggy Co.	Connersville, Ind.																
Continental	Continental Truck Mfg. Co.	Superior, Wis.					1½			3								
Corbitt	Corbitt Auto Co.	Henderson, N. C.					1½											
Couple-Gear	Couple-Gear Freight Wheel Co.	Grand Rapids, Mich.									3½			5				
Couple-Gear*	Couple-Gear Freight Wheel Co.	Grand Rapids, Mich.									3½			5				
Cowan Transveyor**	Cowan Truck Co.	Holyoke, Mass.						2										
Crawford	Crawford Automobile Co.	Hagerstown, Md.								3								
Crescent	Crescent Motor Truck Co.	Middletown, O.								3				5				
Croce	Croce Auto Co.	Asbury Park, N. J.			¾			2										
Crown	Crown Commercial Car Co.	North Milwaukee, Wis.			¾		1½		2½									
C. T.	Commercial Truck Co. of America	Philadelphia, Pa.												5				
C. T.*	Commercial Truck Co. of America	Philadelphia, Pa.		½		1		2			3½			5				
Curtis	Pittsburgh Machine Tool Co.	Braddock, Pa.						2		3								
Daimler, American	General Vehicle Co.	Long Island City, N. Y.														6		
Dain	Dain Mfg. Co.	Ottumwa, Ia.				1												
Dart	Dart Motor Truck Co.	Waterloo, Ia.		½		1		2										
Dayton	Durable Dayton Truck Co.	Dayton, O.				1						4						
Dayton*	Dayton Electric Car. Co.	Dayton, O.																
Decatur	Parcel Post Equipment Co.	Grand Rapids, Mich.	⅜			1												
DeKalb	DeKalb Wagon Works	DeKalb, Ill.					1½		2½									
Denby	Denby Motor Truck Co.	Detroit, Mich.			¾	1												
Detroit*	Anderson Electric Car Co.	Detroit, Mich.						2										
Diamond-T	Diamond-T Motor Car Co.	Chicago, Ill.			¾		1½			3								
Dispatch	Dispatch Motor Car Co.	Minneapolis, Minn.		⅝														
Doane	Doane Motor Truck Co.	San Francisco, Cal.														6		
Dorris	Dorris Motor Car Co.	St. Louis, Mo.			¾			2										
Duffy	Duffy Bros. Motor Truck Co.	San Francisco, Cal.																
Dunlap*	Dunlap Electric Co.	Columbus, O.		½														
Duplex	Duplex Power Car Co.	Charlotte, Mich.						2		3								
Durocar	Amalgamated Motors Corp.	Alhambra, Cal.		½														
Duryea	Duryea Laboratories	Philadelphia, Pa.		½														
Dynamic**	Cleveland-Galion Motor Truck Co.	Galion, O.																
Eastern	Eastern Power Truck Co.	Providence, R. I.																
Edison*	Edison Electric Vehicle Co.	Lawrence, Mass.																
Electromobile**	Electromobile Co.	St. Louis, Mo.				1	1½											
Elwell-Parker**	Elwell-Parker Electric Co.	Cleveland, O.						2										

*Electric. **Electric Industrial (internal service). Steam.

Courtesy of The Commercial Vehicle.

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Gasoline and Electric Vehicles Now Built Commercially

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models* Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
Erie	Erie Motor Truck Mfg. Co	Erie, Pa																
Evans	Evans Motor Car & Parts Mfg. Co	Travers City, Mich																
Fargo	Fargo Motor Car Co	Chicago, Ill			¾	1												
Fawick	Fawick Motor Car Co	Sioux Falls, S. D		½	¾	1		2										
Federal	Federal Motor Truck Co	Detroit, Mich					1½											
Field*	Field Omnibus Co	New York City																
Flint	Durant-Dort Carriage Co	Flint, Mich				1												
Forschler	Phillip Forschler Wagon Co	New Orleans, La					1½											
Four Wheel Drive	Four Wheel Drive Auto Co	Clintonville, Wis						2		3						6		
Franklin	Franklin Commercial Truck Co	Franklin, Pa																
Fremont-Mais	Lauth-Juergens Motor Car Co	Fremont, O						2										
Fritchle*	Fritchle Automobile & Battery Co	Denver, Col																
Fuller	Fuller Power Truck Co	Delphos, O																
Gabriel	Gabriel Auto Co	Cleveland, O		½	¾		1½											
Garford	Willys-Overland Co	Toledo, O						2		3		4		5		6		
G. A. Schacht	G. A. Schacht Motor Truck Co	Cincinnati, O						2		3								
Gay	S. G. Gay Co	Ottawa, Ill			¾	1												
Geneva	Geneva Wagon Co	Geneva, N. Y			¾													
GMC	General Motors Truck Co	Pontiac, Mich			¾		1½	2			3½			5				
GMC*	General Motors Truck Co	Pontiac, Mich		½		1	1½	2		3		4		5		6		
Golden West	Golden West Motors Co	Sacramento, Cal																
Gramm	Gramm Motor Truck Co	Walkerville, Ont					1½	2			3½			5				
Great Eagle	United States Carriage Co	Columbus, O																
Great Southern	Great Southern Auto Co	Birmingham, Ala																
G.V.*	General Vehicle Co	Long Island City, N. Y		½		1		2			3½			5				
G.V.**	Genera lVehicle Co	Long Island City, N. Y						2										
Hahn	Hahn Motor Truck Co	Hamburg, Pa																
Handy Wagon	Auburn Motor Chassis Co	Auburn, Ind	¼	⅝	⅞													
Harrison	Robert Harrison Co	South Boston, Mass																
Harvey	Harvey Motor Truck Works	Harvey, Ill					1½			3								
Hercules	Hercules Motor Truck Co	South Boston, Mass																
Hoagland-Thayer**	Hoagland-Thayer, Inc	Newark, N. J						2						5T				
Homer	Homer Motors Co	Los Angeles Cal		½														
Horner	Detroit-Wyandotte Motor Co	Wyandotte, Mich				1	1½	2		3				5				
Hunt**	C. W. Hunt Co	West New Brighton, N. Y						2										
Hupmobile	Hupp Motor Car Co	Detroit, Mich	⅜															
Hurlburt	Hurlburt Motor Truck Co	New York City				1		2			3½							
Ideal	Ideal Auto Co	Fort Wayne, Ind				1	1½		2½									
IHC	International Harvester Corp	Akron, O		½														
Independent	Independent Motors Corp	Port Huron, Mich			¾		1½											
Indiana	Harwood-Barley Co	Marion, Ind					1½			3				5				
Imp	W. H. McIntyre Co	Auburn, Ind	¼															
Jeffery	Thomas B. Jeffery Co	Kenosha, Wis			¾		1½	2										
Juno	Juno Motor Truck Co	Juneau, Wis																
Kalamazoo	Kalamazoo Motor Truck Co	Kalamazoo, Mich					1½											
Kanawha	Kanawha Auto Truck Co	Charleston, W. Va																
Kearns	Kearns Motor Car Co	Beavertown, Pa		⅝														
Kelly	Kelly-Springfield Motor Truck Co	Springfield, O				1		2			3½			5				
King	A. R. King Mfg. Co	Kingston, N. Y									3½							
Kisselkar	Kissel Motor Car Co	Hartford, Wis			¾	1	1½		2½		3½					6		
Kleiber	Kleiber Co., Inc	San Francisco, Cal					1½		2½		3½			5				
Knox Tractor	Knox Motors Co	Springfield, Mass														6T		10T
Koehler	H. J. Koehler S. G. Co	Newark, N. J				1												
Kopp	Kopp Motor Truck Co	Buffalo, N. Y					1½			3				5				
Kosmath	Kosmath Co	Detroit, Mich		½														
Krebs	Krebs Commercial Car Co	Clyde, O				1		2										
LaFrance	American LaFrance Fire Engine Co	Elmira, N. Y												5				
Lambert	Buckeye Mfg. Co	Anderson, Ind	⅜		¾	1	1½	2										
Lange	Lange Motor Truck Co	Pittsburgh, Pa					1½		2½									
Lansden*	Lansden Co., Ltd	Brooklyn, N. Y																
Lauth-Juergens	Lauth-Juergens Motor Car Co	Fremont, O				1		2		3				5				
Lewis	Lewis Motor Truck Co	San Francisco, Cal							2½	3				5				
Lippard-Stewart	Lippard-Stewart Motor Car Co	Buffalo, N. Y			¾	1	1½	2										
Little Giant	Chicago Pneumatic Tool Co	Chicago, Ill				1												
Locomobile	Locomobile Co. of America	Bridgeport, Conn								3		4		5		6		
Lord Baltimore	Lord Baltimore Motor Car Co	Baltimore, Md				1		2										
Maccar	Maccar Co	Scranton, Pa				1	1½	2										
Mack	International Motor Co	New York City				1								5		6		
M & E	Merchant & Evans	Philadelphia, Pa									3½			5				
Mais	Mais Motor Truck Co	Indianapolis, Ind					1½	2	2½	3								8T
Mansur	Mansur Motor Truck Co	Haverhill, Mass																
Marmon	Nordyke & Marmon	Indianapolis, Ind			¾													
Martin	Martin Carriage Works	York, Pa				1	1½		2½		3½							
McIntyre	W. H. McIntyre Co	Auburn, Ind			¾		1½			3								
Menominee	D. F. Poyer & Co	Menominee, Mich			¾	1	1½											
Mercury	Mercury Mfg. Co	Chicago, Ill		½														
Mercury Pullem Tractor**	Mercury Mfg. Co	Chicago, Ill																T.
Milburn*	Milburn Wagon Co	Toledo, O																
Modern	Bowling Green Motor Truck Co	Bowling Green, O				1	1½											
Mogul	Mogul Motor Truck Co	St. Louis, Mo						2				4				6		
Monitor	Monitor Automobile Works	Janesville, Wis		½		1												
Moon	Joseph W. Moon Buggy Co	St. Louis, Mo					1½											
Moore	Pacific Metal Products Co	Torrance, Cal					1½	2		3		4		5				
Moore	Moore Motor Truck Co	Philadelphia, Pa																
Moreland	Moreland Motor Truck Co	Los Angeles, Cal			¾		1½		2½		3½			5			6½	
Morton	Morton Truck & Tractor Co., Inc	Harrisburg, Pa					1½	2	2½	3	3½			5		6		10T
Motokart	Motokart Co	Scranton, Pa	¼															

*Electric. **Electric industrial (internal service). Steam.

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Gasoline and Electric Vehicles Now Built Commercially

Name	Manufacturer	Address	Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
			MODELS IN TONS CAPACITY — Figures do not refer to number of models															
Natco	National Motor Truck Co.	Bay City, Mich.				1												
Nelson & LeMoon	Nelson & LeMoon	Chicago, Ill.				1	1½	2										
Natco	New England Truck Co.	Fitchburg, Mass.					1½											
Nevada	Nevada Mfg. Co.	Nevada, Ia.								3								
New York	Tegetmeier & Riepe Co.	New York City					1½											
O.K.	O. K. Motor Truck Co.	Detroit, Mich.					1½											
Old Hickory	Kentucky Wagon Mfg. Co.	Louisville, Ky.					1½											
Old Hickory*	Kentucky Wagon Mfg. Co.	Louisville, Ky.				1												
Old Reliable	Old Reliable Motor Truck Co.	Chicago, Ill.					1½	2		3		4		5				7
Overland	Willys-Overland Co.	Toledo, O.	⅜															
Owosso	Owosso Motor Car Co.	Owosso, Mich.																
Packard	Packard Motor Car Co.	Detroit, Mich.						2		3		4		5		6		
Palmer	Palmer-Meyer Motor Car Co.	St. Louis, Mo.				1	1½											
Palmer-Moore	Palmer-Moore Co.	Syracuse, N. Y.				1												
Paulding	St. Louis Motor Truck Co.	St. Louis, Mo.	⅜		¾	1		2										
Peerless	Peerless Motor Car Co.	Cleveland, O.								3		4		5		6		
Perfex	Perfex Co.	Los Angeles, Cal.		½														
Phoenix	Phoenix Auto Works	Phoenixville, Pa.																
Pierce-Arrow	Pierce-Arrow Motor Car Co.	Buffalo, N. Y.						2						5				
Plymouth	Plymouth Motor Truck Co.	Plymouth, O.				1		2										
Power	Power Vehicle Co.	Milwaukee, Wis.																
Purity*	Purity Bread Co.	St. Paul, Minn.																
Reedsburg	Reedsburg Motor Truck Co.	Reedsburg, Wis.																
Reo	Reo Motor Truck Co.	Lansing, Mich.						2										
Republic	Republic Motor Truck Co.	Alma, Mich.			¾	1	1½											
Rockford	Rockford Motor Truck Co.	Rockford, Ill.																
Roland	Roland Gas Electric Vehicle Corp.	New York City				1				3	3½							
Rowe	Rowe Motor Co.	Downington, Pa.					1½	2		3				5				
Royal	Royal Motor Truck Co.	New York City									3½			5				
Safety-First	Safety-First Motor Car & Truck Co.	Kalamazoo, Mich.																
Sandow	Sandow Truck Co.	Chicago, Ill.					1½	2		3								
Sanford	Sanford Motor Truck Co.	Syracuse, N. Y.			¾		1½	2										
Saxon	Saxon Motor Co.	Detroit, Mich.	¼															
Schleicher	Schleicher Motor Vehicle Co.	New York City						2		3				5				
Selden	Selden Motor Car Co.	Rochester, N. Y.					1½											
Service	Service Motor Truck Co.	Wabash, Ind.				1	1½	2		3				5				
Siebert	Siebert Motor Truck Co.	Toledo, O.			¾													
Signal	Signal Motor Truck Co.	Detroit, Mich.				1												
Smith-Milwaukee	A. O. Smith Co.	Milwaukee, Wis.									3½					6		
South Bend	South Bend Motor Car Works	South Bend, Ind.						2				4						
Speedwell	Speedwell Motor Car Co.	Dayton, O.						2				4				6		
Standard of Detroit	Standard Motor Truck Co.	Detroit, Mich.								3								7
Standard of Ohio	Standard Motor Truck Co.	Warren, O.			¾	1	1½	2			3½							
Stanley†	Stanley Motor Carriage Co.	Newton, Mass.			¾		1½											
Stegeman	Stegeman Motor Car Co.	Milwaukee, Wis.			¾		1½		2½		3½			5				
Sternberg	Sternberg Motor Truck Co.	Milwaukee, Wis.		½				2		3				5		6		7
Stewart	Stewart Iron Works	Covington, Ky.				1												
Stewart	Stewart Motor Corp.	Buffalo, N. Y.			¾													
Storms*	Storms Electric Car Co.	Detroit, Mich.	¼															
Studebaker	Studebaker Corp.	Detroit, Mich.			¾													
Sullivan	Sullivan Motor Car Co.	Rochester, N. Y.					1½											
Tiffin	Tiffin Wagon Co.	Tiffin, O.			¾	1		2										
Toeppner	Toeppner Bros.	Bay City, Mich.																
Toledo	Toledo Motor Truck Co.	Toledo, O.																
Trabold	Trabold Motor Mfg. Co.	Johnstown, Pa.				1		2		3								
Transit	Transit Motor Car Co.	Louisville, Ky.				1		2			3½			5				
Trumbull	Trumbull Motor Car Co.	Bridgeport, Conn.	¼															
Tulsa	Tulsa Automobile & Mfg. Co.	Tulsa, Okla.			¾	1	1½											
Tuttle	Tuttle Motor Co.	Canastota, N. Y.																
United States	United States Motor Truck Co.	Covington, Ky.						2	2½	3		4						
Universal	Universal Motor Truck Co.	Detroit, Mich.					1½			3								
Urban*	Kentucky Wagon Mfg. Co.	Louisville, Ky.			¾		1½		2½			4						
Van Winkle	Van Winkle Motor Truck Co.	Atlanta, Ga.																
Velie	Velie Motor Vehicle Co.	Moline, Ill.				1	1½		2½			4		5				
Vim	Touraine Co.	Philadelphia, Pa.		½														
Veltacar*	Cyeo-Electric Car Co.	New York City	¼															
Vulcan	Driggs-Seabury Ordnance Corp.	Sharon, Pa.							2⅛		3¾		4⅜		5⅛			7⅝
Wagenhals	Wagenhals Motor Car Co.	Detroit, Mich.	⅜															
Wagenhals*	Wagenhals Motor Car Co.	Detroit, Mich.	¼															
Walker*	Walker Vehicle Co.	Chicago, Ill.		½		1		2	2½		3½							
Walter	Walter Motor Truck Co.	New York City												5		6	7½	12T
Ward*	Ward Motor Vehicle Co.	Mount Vernon, N. Y.	⅜	½		1		2			3½			5				
Ware	Ware Motor Vehicle Co.	St. Paul, Minn.								3								
Washington	Washington Motor Car Co.	Hyattsville, Md.												5		6		7
Waverley*	Waverley Co.	Indianapolis, Ind.	¼	½		1		2			3½			5				
West Coast	West Coast Wagon Co.	Tacoma, Wash.																
White	White Co.	Cleveland, O.			¾		1½			3				5				
Whitwood	Whitwood Corp.	Weedsport, N. Y.																
Wichita	Wichita Falls Motor Co.	Wichita Falls, Texas				1		2			3½							
Wilcox	H. E. Wilcox Motor Car Co.	Minneapolis, Minn.		½		1		2		3								
Willet	Willet Engine & Carbureter Co.	Buffalo, N. Y.			¾			2		3								
Willys	Willys-Overland Co.	Toledo, O.			¾													
Wilson	J. C. Wilson & Co.	Detroit, Mich.						2										
Witt-Will	Witt-Will Co.	Washington, D. C.				1		2				4						
Zimmerman	Zimmerman Mfg. Co.	Auburn, Ind.		½														

*Electric. **Electric industrial (internal service). †Steam.

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COST OF SHIPPING MOTOR VEHICLES.

Manufacturers of motor vehicles in the United States contributed nearly $15,000,000 to the earnings of the railroads' freight departments in 1914, according to an estimate reported at the last meeting of the directors of the National Automobile Chamber of Commerce. It required 138,250 cars to transport the vehicles, each car usually carrying from two to six complete machines, and even more when the automobiles were more than ordinarily dismantled for shipment. The increase over shipments for 1913 has been estimated as 14 per cent.

At the same meeting it was announced that the traffic committee of the organization had held two meetings at which freight classification as it relates to the various kinds of self-propelling vehicles was discussed. The proposed extra charge by railroads for placing cars on factory sidings, which has been considered by manufacturers as included in freight rates on automobiles as well as on all other kinds of freight, is receiving the attention of the department, and it is expected that the shippers and the National Automobile Chamber of Commerce will oppose the charge.

Another matter of interest to shippers of motor vehicles is a suggestion by some of the southern railroads that automobile tops be removed for shipment, or a higher rate charged, that in all cases automobiles be covered when shipped, detachable parts removed and packed in iron-bound boxes. These suggestions are being resisted by the traffic department of the N. A. C. C. J. S. Marvin of the traffic department arranged before the Illinois Railroad Commission at Chicago for a more advantageous classification on automobile parts shipped to members of the N. A. C. C. within the State of Illinois and to a considerable extent from points just outside of Illinois.

HUDSON RIVER FERRY TOLLS.

To make the ferry tolls for commercial trucks using the Hudson river ferries between New Jersey and Manhattan uniform is the purpose of the Motor Truck Club of New Jersey, Newark, N. J., which was organized in January. It was said at one of the meetings that hardly any two ferry lines charge the same rate for carrying commercial vehicles, and that one railroad executive was claimed to have said that high rates were charged because no concerted attempt had ever been made to have the rates lowered and made uniform.

A committee of the Chamber of Commerce of Jersey City is said to be co-operating in the plan, while a committee from the Motor Truck Club is working with the Hudson County Municipality Mercantile association. The officers of the club are: David Harper, engaged in the masons' and contractors' supplies business in Harrison, N. J., president; J. L. Black of the Feigenspan Brewing Company, vice president; George Woodward of Igoe Brothers, treasurer; Ralph Beers of the Gottfried Krueger Brewing Company, secretary. None of the officers is a dealer in trucks. The club is receiving the active co-operation of many New Jersey automobile and commercial truck dealers, several of whom are members.

TRUCKS SOLVE TRAFFIC PROBLEMS.

Motor truck service is the solution to the traffic congestion problem in large centres, according to the statement of the Boston Chamber of Commerce in a detailed report of its investigations of traffic in the streets and the railroad terminals in Boston, Mass.

"Development of the motor truck, which is coming more rapidly into general use, will, in our opinion, tend to relieve congestion by moving all kinds of merchandise in larger units and more rapidly", the report states. "The ease with which motor vehicles can be handled and the fact that they occupy less space than horse drawn vehicles, are also distinct advantages. A careful study of the use of motor vehicles, made at the railroad terminals, plainly showed the superiority of the former. The average speed of the motor vehicles was found to be from one to three times as great as that of horse drawn vehicles. Yet the motor truck is in its infancy and it is impossible to forecast the extent of this development.

"The number of motor trucks licensed in 1912 (in Boston) between Jan. 1 and May 15, was 2500. During the same period of 1914 the number of such cars licensed was 4400".

ELECTRIC MOTOR TRUCK SHOW.

For the first time in the history of automobile shows, an exhibition devoted exclusively to machines using electric power for both interior and exterior service, was held in the building of the New Bedford Gas and Edison Light Company, New Bedford, Mass. Practically every kind of an industrial truck, to which class the exhibition was confined, was shown. Beside the exhibits of the General Vehicle Company from its Boston, Mass., service station, which was one of the largest contributors to the show, there was a truck from a Chicago manufacturer, which made the run from Boston to New Bedford, a distance of approximately 56 miles, in 4½ hours, which is considered fast time for a truck made to carry 1000 pounds.

One of the exhibits was a General Vehicle interior truck for use on wharves and in large warehouses, mills, factories, etc. It was equipped with a 10-foot platform with a carrying capacity of 3000 pounds. Included among the advantages of electric motor trucks pointed out, was the fact that five electric trucks would do the haulage of 40 horses, and another was that the trucks do not require as much space, the saving in cost being estimated at from 25 to 35 per cent.

Many of the leading manufacturers of trucks, electric batteries and devices for electric automobiles in this country were represented by exhibits.

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1915 MOTOR TRUCK BUYERS' GUIDE

The Characteristics of Chassis in the Market Classified by Load Capacities.

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Brasie. . . . . . .Packet	600	$375	100	Pneu..	10.00	Fric...	Dbl chn.	Price
Decatur. VI	800	630	102	Pneu..	12.08	Selec...	Sing chn.	Rear spring
Handy Wagon, Jr...	500	390	65	Solid..	11.25	Plan..	Dbl chn.	Convertible
Handy Wagon......	800	487.50	77	Solid..	13.60	Plan..	Dbl chn.	Convertible
Hupmobile. . . . . HT	800	850	106	Pneu..	16.92	Selec..	Bevel...	Low floor
Lambert. VI	800	900	106	Pneu..	22.50	Fric...	Sing chn.	Friction drive
Motokart. . . . . .1&2	500	365	69	Pneu..	10.53	Fric...	Sing chn.	Price
Overland. 81	800	850-c*	106	Pneu..	25.60	Selec..	Bevel...	Standard car
Paulding. . . . . .O	800	650	95	Pneu..	12.08	Selec..	Bevel...	Standard car
Saxon. A2	400	395-c	96	Pneu..	11.23	Prog..	Bevel...	Price
Trumbull. 15D	500	395-c	80	Pneu..	13.37	Selec..	Bevel...	Price
Wagenhals.	800	690-c	80	P&C..	19.61	Plan..	Sing chn.	3-wheeler

TRUCKS OF ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Bauer. . . . . .A	1,000	$900	100	Solid..	22.50	Selec..	Dbl-red..	Double-red. drive
Best. . . . . .A	1,200	750	78	Solid*.	16.20	Fric...	Dbl chn.	Friction drive
Chase. . . . . .S	1,000	750	98	Solid..	2-cyc..	Plan..	Dbl chn.	2-cycle motor
Dart. . . . . .A	1,000	845	100	Pneu..	34.28	Selec..	Bevel...	Standard car
Gabriel, ...K	1,000	1,200	112	Pneu..	19.61	Selec..	Bevel...	Standard car
Handy Wagon, Sr...	1,200	600	86	Solid..	18.10	Plan..	Dbl chn.	Convertible
IHC. . . . . .M	1,000	......	90	Solid..	16.20	Ind-c..	Dbl chn.	High wheels
Kosmath. 14	1,000	850	110	Pneu..	19.61	Selec..	Bevel...	Standard car
Mercury. . . . . .P	1,000	......	84	Solid..	14.50	Plan..	Dbl chn.	Air cooled
O.K., ...C&D	1,200	875	112	Pneu..	19.61	Selec..	Bevel...	Standard car
Sternberg.	1,000	850-c	88	Pneu..	12.08	Selec..	Worm...	Worm drive
Vim. . . . . .L&S	1,000	620	94	Pneu..	12.40	Selec..	Bevel...	Price
Wilcox. . . . . .T	1,000	1,000	115	Pneu..	19.61	Selec..	Bevel...	Standard car

TRUCKS OF ¾-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Atterbury. . . . . .AW	1,500	$1,800	118	Pneu..	19.61	Selec..	Worm...	Worm drive
Auglaize. . . . . .H	1,500	950	100	Solid..	22.10	Selec..	Bevel...	Governor
Auglaize. . . . . .D	1,500	950	100	Solid..	22.50	Selec..	Bevel...	Governor
Bauer. . . . . .B	1,500	1,150	110	Solid..	22.50	Selec..	Dbl-red..	Double red. drive
Brockway. . . . . . . .G	1,500	1,205	100	Solid..	19.61	Selec..	Dbl chn.	Wood frame
Buick. C4	1,500	1,150	120	Pneu..	22.50	Selec..	Bevel...	Valves in head
Chase. . . . . .T	1,500	1,500	135	Solid..	19.61	Selec..	Worm...	Worm drive
Commerce. . . . . . . .S	1,500	875	107	Pneu..	19.61	Selec..	Bevel...	Cast radiator
Crown. . . . . .A	1,500	2,000	120	Pneu..	22.50	Selec..	Worm...	Worm drive
Denby. . . . . .A	1,500	1,500	120	Solid..	19.61	Selec..	Int-g....	Int-gear drive
Dorris. 1A4	1,500	1,950	132*	Pneu..	30.65	Selec..	Bevel...	Valves in head
Fargo. . . . . .E	1,500	750	100	Solid..	16.20	Fric...	Bevel...	Price
Gabriel. . . . . .H	1,500	1,600	126	Pneu..	22.50	Selec..	Bevel...	Standard car
Geneva. . . . . .B	1,500	700	96	Solid..	21.10	Plan..	Dbl chn.	Price
GMC. 15	1,500	1,090	122	Pneu..	19.61	Selec..	Bevel...	Standard car
Independent. . . . . .F	1,500	1,285	112*	Solid..	19.61	Selec..	Worm...	Worm drive
Jeffery, ...1515	1,500	1,300	118	Pneu..	22.50	Selec..	Bevel...	Standard car
Kisselkar. 1500	1,500	1,500	125	Pneu..	29.00	Selec..	Bevel...	Standard car
Lambert. V2	1,500	1,125	114	Pneu*.	22.50	Fric..	Dbl chn.	Friction drive
Lippard-Stew.. . .B*	1,500	1,650	115*	Pneu..	22.50	Selec..	Bevel...	French hood
Lippard-Stew.. BW*	1,500	1,775	115*	Pneu..	22.50	Selec..	Worm...	Worm drive
McIntyre. . . . . .E	1,500	......	120	Solid..	22.50	Selec..	Dbl chn.	Standard car
Menominee. A3	1,500	1,125	112	Solid..	22.50	Selec..	Bevel...	Standard car
Moreland. 7X	1,500	1,800	126	Solid*.	22.50	Selec..	Worm...	Distillate fuel
Paulding. . . . . .H	1,500	950	120	Solid..	19.61	Selec..	Dbl chn.	Standard car

TRUCKS OF ¾-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Republic, ... 1500	1,500	......	124	Solid*.	19.61	Selec..	Int-g....	Int-gear drive
Sanford, ...O	1,500	1,290	120	Solid*.	19.61	Selec..	Int-g....	Int-gear drive
Standard-O, ...DX	1,500	1,700	......	Pneu..	25.60	Selec..	Worm...	Worm drive
Stegeman.	1,500	1,600	125	Pneu..	22.50	Selec..	Bevel...	Standard car
Stewart, ...B	1,500	1,500	124	Pneu..	19.61	Selec..	Bevel...	French hood
Studebaker, ...5	1,500	985	108	Pneu..	19.61	Selec..	Bevel...	Price
Tiffin, ...A	1,500	1,600	112	Solid..	22.50	Selec..	Dbl chn.	Standard car
White, ...GBBE	1,500	2,100	133	Pneu..	22.50	Selec..	Bevel...	Standard car
Willet, ...N	1,500	1,600	125	Pneu..	22.50	Selec..	Dbl-red..	Double red. drive
Willys, ...65	1,500	1,350	120	P&S..	27.20	Selec..	Dbl chn.	Tire equipment

TRUCKS OF 1-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams. . . . . .A	2,000	$1,850	121*	Solid..	22.50	Selec..	Dbl chn.	French hood
Armleder. . . . . .B	2,000	2,200	136	Pneu..	27.20	Selec..	Bevel...	High wheels
Atterbury. . . . . . .BW	2,000	2,100	137	Solid..	22.50	Selec..	Worm...	Worm drive
Available.	2,000	......	Opt...	Solid..	19.61	Selec..	Worm...	Worm drive
Avery. C	2,000	1,690	128	Solid..	27.20	Selec..	Dbl chn.	Standard car
B. A. Gramm. 1	2,000	1,750	130	Solid.	22.50	Selec..	Dbl chn.	Standard car
Barker. . . . . .U	2,000	2,000	130	Solid..	25.60	Selec..	Worm...	Worm drive
Bessemer. C	2,000	1,250	108	Solid..	19.61	Selec..	Dbl chn.	Standard car
Brockway. . . . . . . .H	2,500	1,590	112*	Solid..	22.50	Selec..	Dbl chn.	Wood frame
Coleman. . . . . .D	2,000	1,950	112	Solid..	22.50	Selec..	Dbl chn.	Standard car
Corbitt. . . . . .F	2,500	2,000	130	Solid..	22.50	Selec..	Dbl chn.	Made in South
Dart.	2,000	1,400	114	Solid..	19.61	Selec..	Dbl chn.	Standard car
Dayton. . . . . .U	2,000	1,800	118½	Solid..	29.00	Selec..	Dbl chn.	....
Decatur. C	2,000	1,500	Opt...	Solid*.	22.50	Selec..	Int-g....	Int-gear drive
Denby. . . . . .B	2,000	1,600	120	Solid..	19.61	Selec..	Int-g....	Int-gear drive
Fargo. . . . . .F	2,000	1,250	130	Solid..	22.50	Selec..	Dbl-red..	Double-red. drive
Flint. C	2,000	1,285*	106	Solid..	22.50	Selec..	Dbl-red..	Double-red. drive
GMC. VC	2,500	1,500	126	Solid..	19.61	Selec..	Dbl chn.	Cast radiator
Horner. 1	2,000	2,000	145	Solid..	27.20	Selec..	Dbl chn.	French hood
Hurlburt. 1	2,000	1,500	120	Pneu..	22.50	Selec..	Worm...	Worm drive
Kelly. K30	2,000	2,000	120*	Solid..	22.50	Selec..	Dbl chn.	French hood
Kisselkar. 1	2,000	1,850	140	Pneu..	32.40	Selec..	Bevel...	Standard car
Koehler, ...1	2,000	725	90	Solid*.	22.10	Plan..	Dbl chn.	Price
Krebs. . . . . .G	2,000	1,900	118	Solid..	22.50	Selec..	Worm...	Variable governor
Lambert. V3	2,000	......	120	Solid..	26.27	Fric..	Dbl chn.	Friction drive
Lippard-Stew. . . . .H	2,000	2,000	145	Solid..	22.50	Selec..	Worm...	Worm drive
Little Giant. . . . . . .H	2,000	1,350	110	Solid..	22.50	Selec..	Dbl chn.	Motor under floor
Maccar. . . . . .B	2,000	1,900	138*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Maccar. . . . . .E	2,000	1,900	138*	Solid..	27.20	Selec..	Worm...	Worm drive
Martin. . . . . .R	2,000	2,050	125	Solid..	25.60	Selec..	Dbl chn.	Standard car
Menominee. B3	2,000	1,400	122	Solid..	25.60	Selec..	Dbl-red..	Double-red drive
Modern. L	2,000	1,750	136	Solid*.	22.50	Selec..	Worm...	Worm drive
Natco. 20	2,000	1,025	104	Solid..	19.61	Selec..	Dbl chn.	Motor betw. seats
Nel. & LeMoon. .E1	2,000	1,800	Opt...	Solid..	22.50	Selec..	Worm...	Worm drive
Palmer-Moore. . . . D	2,000	1,300	102	Solid..	2-cyc..	Selec..	Dbl chn.	2-cycle motor
Paulding. . . . . .G	2,000	1,300	120	Solid..	25.60	Selec..	Dbl chn.	Standard car
Republic, ...1	2,000	1,350	124	Solid..	22.50	Selec..	Dbl chn.	Standard car
Roland, ...1	2,000	2,000	120	Solid..	22.50	Selec..	Dbl chn.	Gas-electric
Service. . . . . .W	2,000	2,000	135	Solid..	22.50	Selec..	Worm...	Worm drive
Signal. . . . . .D	2,000	1,400	120	Solid..	22.50	Selec..	Dbl chn.	Standard car
Signal. . . . . .DL	2,000	1,450	144	Solid..	22.50	Selec..	Dbl chn.	Standard car
Signal. . . . . .F	2,000	1,500	120	Solid..	22.50	Selec..	Worm...	Worm drive
Signal, ...FL	2,000	1,550	144	Solid..	22.50	Selec..	Worm...	Worm drive
Standard-O. . . . . . .A	2,000	1,700	134	Solid*.	25.60	Selec..	Dbl chn.	Standard car
Standard-O, ...AX	2,000	1,900	124	Solid*.	25.60	Selec..	Worm...	Worm drive
Stewart-K. C	2,000	1,100	96	Solid..	20.00	Plan..	Dbl chn.	Motor under seats
Tiffin . . . . .G	2,000	2,000	128	Solid..	22.50	Selec..	Dbl chn.	Standard car
Trabold. . . . . .T	2,000	1,250	118	Solid..	19.61	Selec..	Worm*.	Worm drive
Transit. . . . . .E	2,000	2,000	120*	Solid..	32.40	Selec..	Dbl chn.	Opt. motor locat'n
Velie. X	2,000	2,000	129*	Solid*.	34.28	Selec..	Dbl-red..	Double-red. drive
Wichita. . . . . .A	2,000	1,650	110	Solid..	16.92	Selec..	Dbl chn.	Standard car
Wilcox. L. . . . . .A	2,000	2,000	132	Solid*.	27.20	Selec..	Dbl chn.	Standard car

TRUCKS OF 1½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, ...D	3,000	$2,300	121*	Solid..	27.20	Selec..	Dbl chn.	French hood
Aetna, ...1½	3,000	2,150	158	Solid..	25.60	Selec..	Worm...	Worm drive

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price, -c,** *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive, Bevel,** *direct bevel;* Dbl-red, *double-reduction bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

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TRUCKS OF 1½-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Armleder .... H	3,000	$2,150	Opt...	Solid..	32.40	Selec..	Dbl chn.	High wheels
Autocar 21F	3,000	1,850	97	Opt....	18.10	Prog..	Dbl-red..	Motor under
Bessemer .... A	3,000	1,800	136	Solid..	27.20	Selec..	Dbl chn.	Standard car seat
Beck	3,000	1,600	130	Solid..	27.20	Selec..	Int-g....	Int-gear drive
Chase .... R	3,000	2,300	Opt	Solid..	22.50	Selec..	Worm...	Worm drive
Continental ..... F	3,000	1,700	144	Solid..	16.92	Selec..	Opt.....	Standard car
Crown .... B	3,000	2,500	140	Solid..	25.60	Selec..	Worm...	Worm drive
DeKalb D1	3,000	1,950	134	Solid..	27.20	Selec..	Dbl chn.	Standard car
Federal .... GH	3,000	1,800	120*	Solid..	27.20	Selec..	Dbl chn.	Cast radiator
Federal .. GW-HW	3,000	1,900	120*	Solid..	27.20	Selec..	Worm...	Worm drive
Forschler 1A	3,000	2,300	124*	Solid..	27.20	Selec..	Dbl chn.	Double frame
Gabriel .... M	3,000	2,300	144	Pneu..	27.20	Selec..	Bevel...	Standard car
Gramm 1½	3,000	2,600	129	Solid..	22.50	Selec..	Dbl chn.	Motor betw. seats
Harvey.......... F	3,000	1,800	130	Solid..	22.50	Selec..	Dbl chn.	Standard car
Independent ..... E	3,000	1,850	122*	Solid..	22.50	Selec..	Dbl chn.	Standard car
Indiana .... B	3,000	1,800	135	Solid..	22.50	Selec..	Dvl chn.	Standard car
Jeffery.........3015	3,000	1,650	130	Solid..	22.50	Selec..	Dbl chn.	Standard car
Kalamazoo....... B	3,000	1,590	126	Solid..	22.50	Selec..	Dbl chn.	Standard car
Kisselkar 1½	3,000	2,100	132*	Solid..	29.00	Selec..	Dbl chn.	Standard car
Kleiber.......... 1	3,000	2,000	140*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Lambert V4	3,000	1,900	120	Solid..	32.40	Fric...	Dbl chn.	Friction drive
Lange C	3,000	2,250	125	Solid..	22.50	Ind-c..	Dbl chn.	Ind-clutch gearset
Lippard-Stew ..... F	3,000	2,300	145*	Solid..	27.20	Selec..	Worm...	Worm drive
Maccar.......... C	3,000	2,150	150*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Mais C	3,000	2,750	119	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Mais .... D	3,000	2,800	132	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Martin.......... S	3,000	2,150	121	Solid..	25.60	Selec..	Dbl chn.	Standard car
McIntyre......... A	3,000	......	144	Solid..	27.20	Selec..	Dbl chn.	Standard car
Menominee....... C	3,000	1,800	130	Solid..	25.60	Selec..	Dbl-red...	Double-red. drive
Modern.......... H	3,000	1,950	136*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Modern .... M	3,000	2,000	136*	Solid..	27.20	Selec..	Worm...	Worm drive
Moon............ B	3,000	1,800	125*	Solid..	22.50	Selec..	Dbl chn.	Standard car
Moore 1½	3,000	1,950	145	Solid..	27.20	Selec..	Dbl chn.	Standard car
Moreland........ 1X	3,000	2,050	120	Solid..	27.20	Selec..	Worm...	Distillate fuel
Nel. & LeMoon..E1½	3,000	2,000	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Netco............ C	3,000	2,250	144	Solid..	27.20	Selec..	Worm...	Worm drive
New York L	3,000	2,000	129	Solid..	16.92	Selec..	Dbl chn.	Standard car
Old Hickory .. 30W	3,000	1,900	110	Solid..	22.50	Selec..	Worm...	Worm drive
Old Reliable 1½	3,000	2,250	138	Solid..	22.50	Selec..	Worm...	Worm drive
Republic 1½	3,000	1,475	144	Solid..	22.50	Selec..	Dbl chn.	Price
Rowe...........CW	3,000	2,450	144	Solid..	25.60	Selec..	Worm...	Worm drive
Sandow 1½	3,000	1,900	125*	Solid..	22.50	Selec..	Dbl chn	Standard car
Sanford .... K	3,000	1,660	106	Solid..	25.60	Selec..	Dbl chn.	Standard car
Selden.......... JB	3,000	2,000	150	Solid..	22.50	Selec..	Dbl chn.	Standard car
Service.......... Q	3,000	1,975	150	Solid..	27.20	Selec..	Dbl chn.	Standard car
Standard-O....... B	3,000	1,800	132*	Solid..	25.60	Selec..	Dbl chn.	Standard car
Standard-O .... BX	3,000	2,100	134*	Solid..	25.60	Selec..	Worm...	Worm drive
Stegeman	3,000	2,100	150	C&S .	22.50	Selec..	Dbl chn.	Chain cases
Sullivan ....G	3,000	1,600	129	Solid..	22.50	Selec..	Dbl chn.	Standard car
Universal C	3,000	1,950	132	Solid..	22.50	Selec..	Worm...	Worm drive
Velie .... U	3,000	2,250	140	Solid..	34.28	Selec..	Worm...	Worm drive
White .... TBC	3,000	3,000	145½	Pneu..	22.50	Selec..	Dbl-red..	Double-red. drive

TRUCKS OF 2-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, E	4,000	$2,500	140*	Solid..	27.20	Selec..	Dbl chn.	French hood
Armleder, E.......	4,000	2,500	Opt...	Solid..	32.40	Selec..	Dbl chn.	High wheels
Atterbury .... CW	4,000	2,800	153	Solid..	27.20	Selec..	Worm...	Worm drive
Available.........	4,000	.....	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Avery .... B	4,000	2,700	128	Solid..	36.15	Selec..	Dbl chn.	Motor under floor
B. A. Gramm 2	4,000	2,550	146	Solid..	29.00	Ind-c..	Worm...	Worm drive
barker V	4,000	2,400	136	Solid..	25.60	Selec..	Worm...	Worm drive
Bessemer .... D	4,000	2,300	136	Solid..	27.20	Selec..	Worm...	Worm drive
Blair........... C1	4,000	2,850	114*	Solid..	27.20	Ind-c..	Worm...	Worm drive
Brasie ... Twin City	4,000	1,350	104	Solid..	20.00	Plan..	Dbl chn.	Price
Brasie ... Twin City	4,000	1,350	104	Solid..	22.50	Selec..	Dbl chn.	Price
Brockway I	4,000	1,875	120*	Solid..	27.20	Selec..	Dbl chn.	Wood frame
Coleman .... G	4,000	2,450	124	Solid..	22.50	Selec..	Dbl chn.	Motor under seats
Curtis............	4,000	2,750	130	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Dart.............	4,000	1,800	130*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Dorris 1A4	4,000	2,500	144*	Solid..	30.65	Selec..	Dbl chn.	Valves in head
Duplex C	4,000	2,800	130	Solid..	27.20	Selec..	Int-g....	4-wheel drive
Four Wheel Drive.G	4,000	3,400	124	Solid..	29.00	Selec..	Bevel-4..	4-wheel drive
Fremont-Mais ... O	4,000	1,700*	132*	Solid..	22.50	Prog..	Int-g....	Int-gear drive
Garford L	4,000	3,000	128*	Solid..	36.15	Selec..	Dbl chn.	Motor betw. seats
G. A. Schacht ... 2	4,000	2,800	138	Solid..	29.00	Selec..	Worm...	Worm drive
GMC .... SC	4,000	1,900	143	Solid..	25.60	Selec..	Dbl chn.	Standard car
Gramm 2	4,000	3,600	128	Solid..	32.40	Selec..	Dbl chn.	Motor betw. seats

TRUCKS OF 2-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Horner 2	4,000	$2,650	145	Solid.	27.20	Selec..	Dbl chn.	French hood
Hurlburt 2	4,000	3,000	Opt...	Solid..	27.20	Selec.	Worm...	Worm drive
Jeffery 4015	4,000	2,750	124	Solid..	22.50	Selec..	Int-g-4..	4-wheel drive
Kelly K-35	4,000	2,750	144*	Solid..	22.50	Selec..	Dbl chn.	French hood
Krebs .... H	4,000	2,350	144*	Solid..	27.20	Selec..	Worm...	Variable governor
Lambert V5	4,000	2,300	120	Solid..	32.40	Fric...	Dbl chn.	Friction drive
Lippard-Stew ....G	4,000	2,600	158*	Solid..	27.20	Selec..	Worm...	Worm drive
Maccar .... F	4,000	2,400	150*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Maccar .... D	4,000	2,400	150*	Solid..	27.20	Selec..	Worm...	Worm drive
Mais .... E	4,000	2,950	132	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Mais .... F	4,000	3,000	145	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Moore........... 2	4,000	2,500	163	Solid..	32.40	Selec..	Dbl chn.	Standard car
Nel. & LeMoon.. E2	4,000	2,250	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Packard 2	4,000	2,800	120*	Solid..	26.39	Prog..	Dbl chn.	Standard car
Paulding .... M	4,000	1,950	145	Solid.	34.28	Selec..	Dbl chn.	Standard car
Pierce-Arrow 2	4,000	3,000	150*	Solid..	25.60	Selec..	Worm...	Worm drive
Reo .... J	4,000	1,650	130*	Solid..	27.20	Selec..	Dbl chn.	Knock-down rad.
Rowe .... DW	4,000	2,800	150	Solid..	29.00	Selec..	Worm...	Worm drive
Sandow 2	4,000	2,250	125*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Sanford L	4,000	1,910	118	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Sanford .... M	4,000	1,910	140	Solid..	27.20	Selec..	Dbl chn.	Standard car
Service .... P	4,000	2,375	150	Solid.	27.20	Selec..	Dbl chn.	Standard car
Service .... PW	4,000	2,500	160	Solid.	27.20	Selec..	Worm...	Worm drive
South Bend 40	4,000	2,000	136*	Pneu*.	26.50	Selec..	Dbl chn.	Standard car
Speedwell 8Y	4,000	2,850	115	Solid.	27.20	Selec..	Dbl chn.	Motor under floor
Standard-O C	4,000	2,000	144*	Solid*	25.60	Selec..	Dbl chn.	Standard car
Sternberg.........	4,000	2,800	148*	Solid.	22.50	Ind-c..	Worm...	Worm drive
Trabold..........	4,000	2,450	130	Solid.	27.20	Selec..	Worm*.	Worm drive
Transit .... F	4,000	2,850	144	Solid.	32.40	Selec..	Dbl chn	Opt. motor locat'n
U. S. .... E	4,000	2,550	132	Solid.	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Wichita .... B	4,000	2,100	118	Solid.	19.61	Selec.	Dbl chn	Standard car
Wilcox .... NA	4,000	2,500	118	Solid.	29.00	Selec.	Dbl chn	Motor under floor
Willet L	4,000	2,600	144	Solid.	27.20	Selec.	Dbl chn	French hood
Wilson .... B	4,000	1,800	130*	Solid.	27.20	Selec.	Dbl chn	Standard car

TRUCKS OF 2½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Aetna 2½	5,000	$2,400	158	Solid.	34.28	Selec..	Worm..	Worm drive
Beck.............	5,000	1,850	130	Solid..	40.00	Selec..	Int-g....	Int-gear drive
Crown C	5,000	3,000	150	Solid..	29.00	Selec..	Worm..	Worm drive
DeKalb D2	5,000	2,450	136	Solid .	27.50	Selec..	Dbl chn	Standard car
Kisselkar 2½	5,000	2,750	144*	Solid.	32.40	Selec..	Dbl chn	Standard car
Kleiber 2	5,000	2,750	150*	Solid.	27.20	Selec..	Dbl chn	Standard car
Lange .... B	5,000	3,000	136	Solid.	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Lewis 21	5,000	2,900	144	Solid.	29.00	Ind-c..	Dbl chn.	Ind.-clutch gears't
Mais .... G	5,000	3,200	145	Solid.	29.69	Prog..	Int-g....	Int-gear drive
Martin .... E	5,000	3,000	135	Solid.	27.20	Selec..	Dbl chn	Motor under floor
Moreland 2X	5,000	2,650	144	Solid.	32.40	Selec..	Worm...	Distillate fuel
Stegeman.........	5,000	2,800	142	Solid.	29.00	Selec..	Dbl chn	Chain cases
U. S. ....G	5,000	2,750	138	Solid.	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Velie.............	5,000	2,850	148*	Solid.	32.40	Selec.	Dbl chn	Standard car
Vulcan 2	5,000	2,750	150*	Solid.	29.00	Selec.	Dbl chn	English design

TRUCKS OF 3-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A&B........... 3-T	6,000	.....	144	Solid..	42.76	Elec..	Int-g-f ..	Gas-electric
Atterbury ..... DW	6,000	$3,800	168	Solid..	32.40	Selec.	Worm...	Worm drive
Avery........... A	6,000	2,500c	140	Wood	36.15	Selec..	Dbl chn.	Farm truck
Avery........... B	6,000	3,200	128	Solid.	36.15	Selec..	Dbl chn.	Motor under floor
Blair B1	6,000	3,250	120*	Solid..	36.15	Ind-c..	Worm...	Worm drive
Chase .... O	6,000	3,300	175	Solid..	32.40	Selec..	Worm...	Worm drive
Coleman .... H	6,000	3,000	134	Solid..	27.20	Selec..	Dbl chn	Motor under seat
Continental ..... G	6,000	2,700	144	Solid..	16.92	Selec..	Opt.....	Standard car
Crawford..........	6,000	3,000	144	Solid..	32.40	Selec..	Dbl chn.	Standard car
Curtis............	6,000	3,250	130	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Duplex .... D	6,000	3,200	130	Solid..	29.00	Selec..	Int-g-4..	4-wheel drive
Four Wheel Drive. B	6,000	4,000	124	Solid..	36.15	Selec..	Bevel-4..	4-wheel drive
Garford .... J	6,000	3,500	128*	Solid..	36.15	Selec..	Dbl chn.	Motor betw. seats
G. A. Schacht 3	6,000	3,200	150	Solid..	29.00	Selec..	Worm...	Worm drive
Harvey .... H	6,000	3,000	168	Solid..	29.00	Selec..	Dbl chn	Standard car
Horner............3	6,000	3,200	145	Solid..	32.40	Selec..	Dbl chn	French hood
Indiana .... F	6,000	2,500	144	Solid..	29.00	Selec..	Dbl chn.	Standard car

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction, bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

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TRUCKS OF 3-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Lewis 31	6,000	$3,250	144	Solid..	29.00	Ind-c..	Dbl chn	Opt. motor locat'n
Locomobile 3	6,000	3,500	150*	Solid..	29.00	Selec..	Worm..	Worm drive
Mais .... H	6,000	3,400	160	Solid..	29.69	Prog..	Int-g...	Int-gear drive
McIntyre ...... G	6,000	......	144	Solid.	27.20	Selec..	Dbl chn	Standard
Moore 3	6,000	3,150	142	Solid..	32.40	Selec..	Dbl chn	Motor under floor
Old Reliable 3	6,000	3,400	122	Solid..	29.00	Selec..	Dbl chn	Motor under floor
Packard 3	6,000	3,400	126*	Solid..	32.40	Prog..	Dbl chn	Standard car
Peerless 3	6,000	3,700	151*	Solid..	32.40	Selec..	Dbl chn	Standard car
Roland 3	6,000	3,500	144	Solid..	29.00	Elec..	Worm..	Gas-electric
Rowe .... EW	6,000	3,400	156	Solid.	25.60	Selec..	Worm..	Worm drive
Sandow 3	6,000	3,000	147*	Solid..	32.40	Selec..	Dbl chn	Standard car
Service .... H	6,000	2,975	171	Solid..	29.00	Selec..	Dbl chn	Standard car
Standard-D 3	6,000	2,750	144	Solid..	32.40	Prog..	Worm*.	Worm drive opt.
Sternberg	6,000	3,400	158*	Solid..	29.00	Ind-c..	Worm..	Worm drive
Trabold	6,000	3,300	130	Solid..	29.00	Selec..	Worm*..	Worm drive
U. S. .... D	6,000	3,200	144	Solid..	32.40	Ind-c..	Dbl chn.	Ind.-clutch gears't
Universal ...... A	6,000	3,400	132	Solid..	25.60	Selec.	Dbl chn	Motor under floor
Ware	6,000	......	......	Solid..	25.60	......	Bevel...	4-wheel drive
White ..... TAD	6,000	3,700	163	Solid..	22.50	Selec..	Dbl chn	Standard car
Wilcox ...... JA	6,000	3,250	128	Solid..	29.00	Selec..	Dbl chn	Motor under floor
Willet .... K	6,000	2,800	144	Solid..	32.40	Selec..	Dbl chn	French hood

TRUCKS OF 3½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
B. A. Gramm 3½	7,000	$3,400	158	Solid.	29.00	Ind-c..	Worm..	Worm drive
Couple-Gear .. H.C	7,000	4,850	144	Solid.	44.20	Elec.	Bevel-4 .	Gas-electric
GMC ...... HU	7,000	2,500	158	Solid.	40.00	Prog..	Dbl chn	Standard car
Gramm 3½	7,000	4,600	140	Solid..	32.40	Selec..	Dbl chn.	Motor betw. seats
Hurlburt 3½	7,000	3,500	Opt...	Solid.	29.00	Selec..	Worm...	Worm drive
Kelly K-40	7,000	3,400	150*	Solid..	32.40	Selec..	Dbl chn	French hood
King 3½	7,000	3,200	120	Solid.	32.40	Ind-c..	Dbl chn.	Motor under floor
Kisselkar 3½	7,000	3,350	162	Solid..	38.25	Selec..	Dbl chn.	Standard car
Kleiber 3	7,000	3,300	160*	Solid..	32.40	Selec..	Dbl chn.	Standard car
M&E ...... B	7,000	3,350	132	Solid.	32.40	Selec..	Dblchn-f	Front drive
Martin L	7,000	3,500	145	Solid.	36.15	Selec..	Dbl chn	Motor under floor
Moreland 3X	7,000	3,500	168	Solid..	36.15	Selec..	Worm...	Distillate fuel
Roland 3½	7,000	3,500	156	Solid.	32.40	Elec..	Dbl chn	Gas-electric
Royal B3½	7,000	3,400	132	Solid..	36.15	Ind-c..	Dbl chn	Motor under floor
Smith .. .. A	7,000	3,750	168	Solid.	40.00	Ind-c..	Worm...	Worm drive
Standard-O C	7,000	3,200	162	Solid..	30.65	Selec.	Dbl chn	Standard car
Stegeman	7,000	3,350	155*	Solid.	32.50	Selec..	Dbl chn.	Chain cases
Transit ...... T	7,000	3,500	144	Solid.	32.40	Selec..	Dbl chn	Opt. motor locat'n
Vulcan 3	7,500	3,250	156*	Solid.	29.99	Selec.	Dbl chn	English design
Wichita ...... H	7,000	3,250	165	Solid..	29.00	Selec.	Dbl chn.	Standard car

TRUCKS OF 4-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Blair E1	8,000	$3,750	135*	Solid..	36.15	Ind-c..	Worm...	Worm drive
Dayton .... A	8,000	2,700	136	Solid..	36.15	Selec..	Dbl chn	Motor under floor
Garford .... K	8,000	3,850	128*	Solid..	36.15	Selec..	Dbl chn	Motor betw. seats
Locomobile....... 4	8,000	3,650	150*	Solid..	29.00	Selec..	Worm..	Worm drive
Moore 4	8,000	3,500	153	Solid..	36.15	Selec..	Dbl chn	Motor under floor
Old Reliable 4	8,000	4,000	126	Solid..	36.15	Selec..	Dbl chn.	Motor under floor
Packard 4	8,000	3,500	126*	Solid..	32.40	Prog..	Dbl chn.	Standard car
Peerless 4	8,000	4,000	151*	Solid.	32.40	Selec..	Dbl chn.	Standard car
South Bend 80	8,000	3,000	152	Pneu*.	44.20	Selec.	Dbl chn	Standard car
Speedwell 10Z	8,000	3,750	115	Solid..	40.00	Selec..	Dbl chn.	Motor under floor
U. S. .... F	8,000	3,550	156	Solid..	32.40	Ind-c..	Dbl chn	Ind.-clutch gears't
Velie .... Z	8,000	3,350	148*	Solid.	32.40	Selec.	Dbl chn	Standard car

TRUCKS OF 4½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Vulcan 4	9,200	$4,000	162	Solid..	29.99	Ind-c..	Dbl chn	English design

TRUCKS OF 5-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A & B 5-T	10,000	....	144	Solid.	42.76	Elec..	Int-g-f..	Gas-electric
Atterbury .... E	10,000	$4,000	153	Solid..	38.25	Selec..	Dbl chn.	Standard car
Avery .... B	10,000	4,500	128	Solid..	44.20	Selec.	Dbl chn.	Motor under floor
B. A. Gramm 5	10,000	4,300	168	Solid..	40.80	Ind-c..	Dbl chn.	Ind.-clutch gears't
Blair, F	10,000	4,500	135*	Solid..	36.15	Ind-c..	Worm..	Worm drive
Couple-Gear ... AC	10,000	5,400	144	Solid.	53.00	Elec	Bevel-4..	Gas-electric
C. T.	10,000	......	155	Solid..	25.60	Elec	Dblred-4	Gas-electric
GMC .... KU	10,000	3,000	158	Solid..	40.00	Prog..	Dbl chn.	Standard car
Garford .... D	10,000	4,500	128*	Solid..	29.00	Selec.	Dbl chn.	Motor betw. seats
Gramm 5	10,000	5,350	140	Solid..	32.40	Selec.	Dbl chn.	Motor betw. seats
Horner 5	10,000	4,200	156	Solid.	44.20	Selec.	Dbl chn	French hood
Indiana .... K	10,000	3,200	165	Solid.	36.15	Selec.	Dbl chn.	Standard car
Kelly K-50	10,000	4,250	150*	Solid..	32.40	Selec.	Dbl chn.	French hood
Kleiber 5	10,000	4,000	170*	Solid..	40.00	Selec.	Dbl chn.	Standard car
LaFrance 6	10,000	5,500	140	Solid..	48.48	Hyd..	Dbl chn.	Hydraulic drive
Locomobile A2	10,000	4,500	140*	Solid..	40.00	Selec.	Dbl chn.	Motor under floor
M & E .... G	10,000	2,750	116	Sol-st	29.00	Selec.	Dbl chn.	Front drive
Moore 5	10,000	4,500	175	Solid.	44.20	Selec.	Dbl chn.	Motor under floor
Moreland 5X	10,000	4,000	168	Solid.	36.15	Selec.	Dbl chn.	Distillate fuel
Old Reliable 5	10,000	4,000	126	Solid.	36.15	Selec..	Dbl chn.	Motor under floor
Packard 5	10,000	4,150	144*	Solid.	40.00	Prog..	Dbl chn.	Standard car
Peerless 5	10,000	4,500	151*	Solid..	32.40	Selec..	Dbl chn.	Standard car
Pierce-Arrow 5	10,000	4,500	168*	Solid.	38.25	Selec..	Worm...	Worm drive
Rowe .... GW	10,000	4,500	171	Solid.	36.15	......	Worm...	Worm drive
Royal A5	10,000	4,500	138	Solid.	36.15	Ind-c..	Dbl chn.	Motor under floor
Service .... HX	10,000	4,000	175	Solid.	36.15	Selec..	Dbl chn.	Standard car
Stegeman.........	10,000	4,200	168	Solid.	32.40	Selec.	Dbl chn.	Chain cases
Sternberg.........	10,000	4,500	.....	Solid..	32.40	Ind-c..	Worm...	Worm drive
Transit V	10,000	4,500	144*	Solid..	32.40	Selec..	Dbl chn.	Opt. motor locat'n
Velie Z5	10,000	3,750	148*	Solid..	32.40	Selec..	Dbl chn.	Standard car
Walter 5	10,000	4,500	144	Solid.	30.65	Selec..	Int-g-4..	4-wheel drive
White .... TCD	10,000	4,500	165	Solid.	29.00	Selec..	Dbl chn.	Standard car

TRUCKS OF 5½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Vulcan 5	11,005	$1,500	162	Solid..	29.99	Ind-c..	Dbl chn	English design

TRUCKS OF 6-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Daimler-Amer.... FV	12,000	...	169	Solid.	29.00	Selec.	Int-g....	German design
Four Wheel Drive. M	12,000	$4,800	148	Solid.	44.20	Selec..	Bevel-4..	4-wheel drive
Garford .... F	12,000	4,850	128*	Solid.	29.00	Selec..	Dbl chn	Motor betw. seats
Kisselkar 6	12,000	4,350	168	Solid.	38.25	Selec..	Dbl chn	Standard car
Knox-Tractor ... 31	12,000	3,250	139	Solid.	40.00	Selec..	Dbl chn	3-wheeler
Locomobile ... AA2	12,000	4,800	140*	Solid.	40.00	Selec..	Dbl chn	Motor under floor
Packard 6	12,000	4,300	144*	Solid.	40.00	Prog	Dbl chn	Standard car
Peerless 6	12,000	5,000	151*	Solid.	32.40	Selec..	Dbl chn.	Standard car
Smith C	12,000	4,750	168	Solid..	44.20	Ind-c..	Worm...	Worm drive
Speedwell 8X	12,000	4,400	139	Solid.	40.00	Selec.	Dbl chn.	Motor under floor
Sternberg..........	12,000	4,650	144	Solid.	36.15	Ind-c..	Dbl chn	Motor under floor
Walter 6	12,000	4,750	144	Solid..	30.65	Selec.	Int-g-4	4-wheel drive

TRUCKS OF 6½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Moreland 6X	13,000	$1,500	168	Solid..	44.20	Selec.	Dbl chn	Distillate fuel

TRUCKS OF 7-TON CAPACITY AND OVER

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Knox-Tractor ... 32	20,000	$3,750	140	Solid.	40.00	Selec.	Dbl chn	3-wheeler
Mais ...... Tractor	16,000	2,750	84	Solid.	29.69	Prog	Int-g....	Int-gear drive
Old Reliable 7	14,000	5,000	126	Solid.	36.15	Selec.	Dbl chn.	Motor under floor
Standard-D...... 7	14,000	3,300	112	Solid..	32.40	Prog	Dbl chn.	Standard car
Sternberg..........	14,000	4,750	144	Solid.	36.15	Ind-c..	Dbl chn	Motor under floor
Vulcan 7	15,500	6,000	156*	Solid.	36.15	Prog	Dbl chn	English design
Walter 7½	15,000	5,000	144	Solid.	38.25	Selec.	Int-g-4	4-wheel drive
Walter ..... Tractor	24,000	4,500	108	Solid.	38.25	Selec.	Int-g-4	4-wheel drive

CAPACITIES NOT GIVEN

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Bulley Tractor	....	3,400	72	Solid.	30.65	Selec.	Dbl chn	3-wheeler

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction, bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

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Specification of Power Wagons and Trucks

Principal Details of the Mechanical Construction of 377 Different Sizes of by 143 Concerns, and the Features of the

PRACTICALITY of construction undoubtedly appeals to the individual investigating motor vehicles with the intention of purchasing, especially if he has experience in operating pleasure cars. What will facilitate the work of the driver will, all else being equal, perhaps have some weight with the investigator, but the main desideratum is to secure constructions that will endure, for more and more the users of motor trucks and wagons are realizing that endurance is the real factor that makes for power vehicle economy.

There are those who assume that power wagon or truck engineering is in a state of transition—that there is uncertainty as to principles so far as these attract buyers, and that purchasing is dependent upon following different theory and practise. As a matter of fact the industry has really accepted the four-cylinder motor as being that best suited for freight carrying vehicles, unqualifiedly approved water cooling, so that the real difference is in power transmission systems.

Considering pleasure car development for a moment, the fact that practically all productions are shaft driven is obvious. The reason is that the chain drive, to be efficient, requires constant attention, and work in connection with the use of an automobile for pleasure is shirked by owner and driver alike. The chain driven types are, if given good care, at least equal to the shaft-propelled, but the people buying pleasure cars desire to minimize labor.

Regarding motor wagon and truck engineering there is a belief becoming prevalent that the shaft drive can be applied to machines designed for freight carrying just as it has been generally adopted for pleasure cars, for the purpose of better protecting wearing parts and minimizing the labor necessary to keep them efficiently operative. This statement is based on the rapidly increasing number of vehicles that are driven by worm shaft and wheel, or by shaft and internal gearing, these affording the same degree of protection of the driving system that obtains with

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheel-base in Inches	TIRES			MOTOR												
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
A & B 3-T	6,000	4,500	144	Solid....	48x3½d	48x3½d	Under hood..	4	5.17	4.75	42.76	Pairs....	Right...	Gear......	Finned....	Dual......	Bosch.....	Hand.....
A & B 5-T	10,000	4,750	144	Solid....	48x3½d	48x5d	Under hood..	4	5.17	4.75	42.76	Pairs....	Right...	Gear......	Finned....	Dual......	Bosch.....	Hand.....
Adams .... A	2,000	1,850	121*	Solid....	36x3½	36x4	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Finned....	Sing......	Eisemann..	Auto......
Adams .... D	3,000	2,300	121*	Solid....	36x3½	36x3½d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Eisemann..	Auto......
Adams .... E	4,000	2,500	140*	Solid....	36x4	36x4d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Eisemann..	Auto......
Aetna 1½	3,000	2,150	158	Solid....	36x3½	36x5	Under hood..	4	4.00	4.50	25.60	Pairs....	Opp....	Cent......	Cell.......	Sing......	Eisemann..	Auto......
Aetna 2½	5,000	2,400	158	Solid....	36x4	36x3½d	Under hood..	4	4.37	6.00	34.28	Pairs....	Opp....	Cent......	Cell.......	Sing......	Eisemann..	Auto......
Armleder .... B	2,000	2,200	136	Pneu....	40x4	39x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Sq-t.......	Sing......	Bosch.....	Hand.....
Armleder .... H	3,000	2,150	Opt	Solid....	40x4	40x6*	Under hood..	4	4.50	5.00	32.40	Block...	Opp....	Cent......	Sq-t.......	Sing......	Bosch.....	Hand.....
Armleder .... E	4,000	2,500	Opt	Solid....	40x4	40x7*	Under hood..	4	4.50	5.00	32.40	Block...	Opp....	Cent......	Sq-t.......	Sing......	Bosch.....	Hand.....
Atterbury .... AW	1,500	1,800	118	Pneu....	35x4½	35x4½	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Finned....	Sing......	Bosch.....	Fixed...:
Atterbury .... BW	2,000	2,100	137	Solid....	36x3½	36x5	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Atterbury .... CW	4,000	2,800	153	Solid....	36x4	36x4d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Atterbury .... DW	6,000	3,800	168	Solid....	36x5	40x5d	Under hood..	4	4.50	5.50	32.40	Pairs....	Left....	Cent......	Finned....	Dual-d...	Bosch.....	Hand.....
Atterbury .... E	10,000	4,000	153	Solid....	36x5	42x6d	Under hood..	4	4.87	5.50	38.25	Pairs....	Opp....	Cent......	Finned....	Dual......	Bosch.....	Fixed.....
Auglaize .... H	1,500	950	100	Solid....	36x2½	36x3	Under seat...	2	5.25	4.00	22.10	Sing....	Head...	Thermo...	Finned....	Dual......	Remy.....	Hand.....
Auglaize .... D	1,500	950	100	Solid....	36x3½	36x4	Under seat...	4	3.75	5.12	22.50	Block...	Left....	Thermo...	Finned....	Dual......	Remy.....	Hand.....
Autocar 21F	3,000	1,850	97	Opt.....	34x4	34x5	Under seat...	2	3.75	4.50	18.10	Sing....	Right...	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Available...........	2,000	......	Opt	Solid....	36x3	36x3½	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Finned....	Sing......	Bosch.....	Fixed.....
Available...........	4,000	......	Opt	Solid....	36x3½	36x6	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Avery C	2,000	1,690	128	Solid....	34x3½	34x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Dual......	Heinze....	Hand.....
Avery .... B	4,000	2,700	128	Solid....	36x4	36x3½d	Under floor..	4	4.75	5.00	36.15	Sing....	Left....	Cent......	Finned....	Dual......	Eisemann..	Auto......
Avery .... B	6,000	3,200	128	Solid....	38x5	38x4d	Under floor..	4	4.75	5.00	36.15	Sing....	Left....	Cent......	Cell.......	Dual......	Eisemann..	Auto......
Avery .... A	6,000	2,500c	140	Wood....	38x5	38x4d	Betw. seats..	4	4.75	5.00	36.15	Sing....	Left....	Cent......	Finned....	Dual......	Eisemann..	Auto......
Avery .... B	10,000	4,500	128	Solid....	38x6	38x5d	Under floor..	4	5.25	5.75	44.20	Pairs....	Opp....	Cent......	Cell.......	Dual......	Eisemann..	Auto......
B. A. Gramm 1	2,000	1,750	130	Solid....	34x3½	36x4	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Cell.......	Sing......	Bosch.....	Hand.....
B. A. Gramm 2	4,000	2,550	146	Solid....	36x4	36x3½d	Under hood..	4	4.25	5.75	29.00	Pairs....	Left....	Cent......	Cell.......	Dual......	Bosch.....	Hand.....
B. A. Gramm 3½	7,000	3,400	158	Solid....	36x5	40x5d	Under hood..	4	4.25	5.75	29.00	Pairs....	Left....	Cent......	Cell.......	Dual......	Bosch.....	Hand.....
B. A. Gramm 5	10,000	4,300	168	Solid....	36x6	40x6d	Under hood..	6	4.12	5.50	40.80	Threes..	Right...	Cent......	Cell.......	Dual......	Bosch.....	Hand.....
Barker .... U	2,000	2,000	130	Solid....	42x3½	42x5	Under hood..	4	4.00	5.00	25.60	Block...	Left....	Thermo...	Cell.......	Sing......	Eisemann..	Auto......
Barker V	4,000	2,400	136	Solid....	36x4	36x7	Under hood..	4	4.00	5.00	25.60	Block...	Left....	Thermo...	Cell.......	Sing......	Eisenamn..	Auto......

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinders Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *Thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honey-comb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-Pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

Courtesy of The Commercial Vehicle.

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Built This Year by American Manufacturers

Gasoline and Gasoline-Electric Service Vehicles, Including Tractors, Produced Standard Equipment of These Machines.

the pleasure cars. With reasonable lubrication there is minimum wear and maximum endurance, and more generally economical service as compared with chains that are not cleaned and used so as to obtain the greatest degree of efficiency.

Material changes in design are not made if standardization has been the purpose of the manufacturer, because of the large cost necessary for experimental work, patterns, fixtures and machinery, and generally endeavor is directed to perfecting what may appear to be insufficient or unsatisfactory in detail; what will make for greater convenience, for increased accessibility, for simplification, for improved lubrication of moving parts and for compensating wear without renewals of parts or sacrifice of efficiency.

With power plants of motor and clutch, or motor clutch and gearset, or with the gearset a unit with the jackshaft, the driving systems are simple, but there is now a much larger number with a combined engine, clutch and gearset, with worm driven rear axle, than were built a year ago. With worm drive the full floating axle has been adopted by the largest number.

A compilation of motor vehicle manufacturers shows there are now more than 250 concerns producing machines, but not all of these are building commercially, and some of them are practically unknown.

The appended tabulation of specifications is of 377 different vehicles built by 143 concerns, the number produced ranging from one to eight, and examination of these indicate that there is surprising unanimity of engineers in constructional details. There is shown, by comparison with the specifications compiled a year ago, an increase of worm driven machines, to 104 models produced by 43 concerns, and to 24 internal gear driven trucks built by 11 firms. Ten different companies construct 28 models of vehicles driven by four wheels. These specifications show that 49 makers build 88 machines in which the tractive effort and the torque are taken by the forward ends of the rear springs, a practise adopted by many the past year.

MOTOR						TRANSMISSION							SPRINGS		CONTROL		Propulsion Taken By	Name and Model
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers		
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
....	....	....	....	Scheb	Circ-spl	....	Elec	Amid	2	28 -1	Int-gear-f.	R-r	½-Ell	½-Ell	Right	Right	R-r	A & B 3-T
....	....	....	....	Scheb	Circ-spl	....	Elec	Amid	2	28 -1	Int-gear-f.	R-r	½-Ell	½-Ell	Right	Right	R-r	A & B 5-T
Cent	Motor	1,300	15	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Adams A
Cent	Motor	1,200	13	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Adams D
Cent	Motor	1,100	12	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Adams E
Cent	D-shft	1,000	15	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	¾-Ell	Left	Cent	Springs	Aetna 1½
Cent	Motor	1,000	14	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	7 -1	Top worm	Springs	½-Ell	¾-Ell	Left	Cent	Springs	Aetna 2½
....	....	1,300	20	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3	5¾-1	Bevel	T-arm	½-Ell	Ellip	Left	Cent	R-r	Armleder B
....	....	1,300	16	Scheb	Splash	Wet-d	Selec	Unit-j	3	8 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Armleder H
....	....	1,300	16	Scheb	Splash	Wet-d	Selec	Unit-j	3	8¼-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Armleder E
....	....	1,200	22½	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury AW
Cent	Motor	1,200	18¾	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury BW
Cent	Motor	1,200	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	9¼-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury CW
Cent	Motor	1,200	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	10⅓-1	Top worm	....	½-Ell	½-Ell	Left	Cent	R-r	Atterbury DW
Cent	Motor	1,200	10	Strom	Circ-spl	Wet-d	Selec	Unit-j	3	12 -1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	Atterbury E
L-b	D-shft	1,200	12	Scheb	Circ-spl	Wet-d	Selec	Unit-j	2	8- 1	Bevel	R-r	½-Ell	½-Ell	Right	Right	R-r	Auglaize H
L-b	D-shft	1,000	18	Scheb	Circ-spl	Wet-d	Selec	Unit-j	3	7 -1	Bevel	R-r	½-Ell	½-Ell	Right	Right	R-r	Auglaize D
None	None	....	20	Strom	Spl-press	Dry-p	Prog	Amid	3	7 -1	Dbl-red	Springs	½-Ell	Plat	Right	Right	Springs	Autocar 21F
Cent	Motor	1,000	16	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Available
Cent	Motor	1,000	14	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Available
Cent	Motor	1,200	15	Ray	Spl-press	Dry-d	Selec	Unit-m	3	7¾-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	Avery C
L-b	Motor	1,200	14½	Ray	Spl-press	Dry-d	Selec	Unit-j	3	3½-1	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,200	13	Ray	Spl-press	Dry-p	Selec	Unit-j	3	3½-1	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,200	12	Ray	Spl-press	Dry-d	Selec	Unit-j	3	3¼-1	Dbl chn	....	½-Ell	¼-Ell	Right	Cent	R-r	Avery A
Cent	Motor	1,000	10	Scheb	Spl-press	Wet-d	Selec	Unit-j	3	12½-1	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,000	16	Scheb	Spl-press	Cone	Selec	Unit-j	3	7 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	B. A. Gramm 1
Cent	Motor	1,000	15	Strom	Spl-press	Dry-d	Ind-c	Amid	3	8¼-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	B. A. Gramm 2
Cent	Motor	1,100	12	Strom	Spl-press	Dry-d	Ind-c	Amid	4	9½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	B. A. Gramm 3½
Cent	Motor	1,000	10	Strom	Spl-press	Dry-d	Ind-c	Amid	4	11 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	B. A. Gramm 5
None	None	1,500	27	Strom	Spl-press	Dry-p	Selec	Unit-m	4	....	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Barker U
None	None	1,500	20	Strom	Spl-press	Dry-p	Selec	Unit-m	4	....	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Barker V

Carbureter Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-ellipitc;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l *gearshift center brake left;* St-col, *steering column.* **Propulsion** R-r *radius rods*, T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.*

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TRUCKS OF 1½-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Armleder H	3,000	$2,150	Opt...	Solid..	32.40	Selec..	Dbl chn.	High wheels
Autocar 21F	3,000	1,850	97	Opt...	18.10	Prog..	Dbl-red..	Motor under
Bessemer A	3,000	1,800	136	Solid..	27.20	Selec..	Dbl chn.	Standard car seat
Beck	3,000	1,600	130	Solid..	27.20	Selec..	Int-g....	Int-gear drive
Chase R	3,000	2,300	Opt...	Solid..	22.50	Selec..	Worm...	Worm drive
Continental F	3,000	1,700	144	Solid..	16.92	Selec..	Opt....	Standard car
Crown B	3,000	2,500	140	Solid..	25.60	Selec..	Worm...	Worm drive
DeKalb D1	3,000	1,950	134	Solid..	27.20	Selec..	Dbl chn.	Standard car
Federal GH	3,000	1,800	120*	Solid..	27.20	Selec..	Dbl chn.	Cast radiator
Federal GW-HW	3,000	1,900	120*	Solid..	27.20	Selec..	Worm..	Worm drive
Forschler 1A	3,000	2,300	124*	Solid..	27.20	Selec..	Dbl chn.	Double frame
Gabriel M	3,000	2,300	144	Pneu..	27.20	Selec..	Bevel...	Standard car
Gramm 1½	3,000	2,600	129	Solid..	22.50	Selec..	Dbl chn.	Motor betw. seats
Harvey F	3,000	1,800	130	Solid..	22.50	Selec..	Dbl chn.	Standard car
Independent E	3,000	1,850	122*	Solid..	22.50	Selec..	Dbl chn.	Standard car
Indiana B	3,000	1,800	135	Solid..	22.50	Selec..	Dvl chn.	Standard car
Jeffery 3015	3,000	1,650	130	Solid..	22.50	Selec..	Dbl chn.	Standard car
Kalamazoo B	3,000	1,590	126	Solid..	22.50	Selec..	Dbl chn.	Standard car
Kisselkar 1½	3,000	2,100	132*	Solid..	29.00	Selec..	Dbl chn.	Standard car
Kleiber 1	3,000	2,000	140*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Lambert V4	3,000	1,900	120	Solid..	32.40	Fric...	Dbl chn.	Friction drive
Lange C	3,000	2,250	125	Solid..	22.50	Ind-c..	Dbl chn.	Ind-clutch gearset
Lippard-Stew F	3,000	2,300	145*	Solid..	27.20	Selec..	Worm...	Worm drive
Maccar C	3,000	2,150	150*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Mais C	3,000	2,750	119	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Mais D	3,000	2,800	132	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Martin S	3,000	2,150	121	Solid..	25.60	Selec..	Dbl chn.	Standard car
McIntyre A	3,000	......	144	Solid..	27.20	Selec..	Dbl chn.	Standard car
Menominee C	3,000	1,800	130	Solid..	25.60	Selec..	Dbl-red..	Double-red. drive
Modern H	3,000	1,950	136*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Modern M	3,000	2,000	136*	Solid..	27.20	Selec..	Worm...	Worm drive
Moon B	3,000	1,800	125*	Solid..	22.50	Selec..	Dbl chn.	Standard car
Moore 1½	3,000	1,950	145	Solid..	27.20	Selec..	Dbl chn.	Standard car
Moreland 1X	3,000	2,050	120	Solid..	27.20	Selec..	Worm...	Distillate fuel
Nel. & LeMoon E1½	3,000	2,000	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Netco C	3,000	2,250	144	Solid..	27.20	Selec..	Worm..	Worm drive
New York L	3,000	2,000	129	Solid.	16.92	Selec..	Dbl chn.	Standard car
Old Hickory 30W	3,000	1,900	110	Solid..	22.50	Selec..	Worm..	Worm drive
Old Reliable 1½	3,000	2,250	138	Solid..	22.50	Selec..	Worm...	Worm drive
Republic 1½	3,000	1,475	144	Solid.	22.50	Selec..	Dbl chn.	Price
Rowe CW	3,000	2,450	144	Solid..	25.60	Selec..	Worm...	Worm drive
Sandow 1½	3,000	1,900	125*	Solid..	22.50	Selec..	Dbl chn	Standard car
Sanford K	3,000	1,660	106	Solid..	25.60	Selec..	Dbl chn	Standard car
Selden JB	3,000	2,000	150	Solid..	22.50	Selec..	Dbl chn	Standard car
Service Q	3,000	1,975	150	Solid..	27.20	Selec..	Dbl chn.	Standard car
Standard-O B	3,000	1,800	132*	Solid..	25.60	Selec..	Dbl chn.	Standard car
Standard-O BX	3,000	2,100	134*	Solid..	25.60	Selec..	Worm...	Worm drive
Stegeman	3,000	2,100	150	C&S..	22.50	Selec..	Dbl chn.	Chain cases
Sullivan G	3,000	1,600	129	Solid..	22.50	Selec..	Dbl chn.	Standard car
Universal C	3,000	1,950	132	Solid..	22.50	Selec..	Worm...	Worm drive
Velie U	3,000	2,250	140	Solid..	34.28	Selec..	Worm...	Worm drive
White TBC	3,000	3,000	145½	Pneu..	22.50	Selec..	Dbl-red..	Double-red. drive

TRUCKS OF 2-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, E	4,000	$2,500	140*	Solid..	27.20	Selec..	Dbl chn.	French hood
Armleder, E	4,000	2,500	Opt...	Solid..	32.40	Selec..	Dbl chn.	High wheels
Atterbury CW	4,000	2,800	153	Solid..	27.20	Selec..	Worm.	Worm drive
Available	4,000	......	Opt...	Solid..	27.20	Selec..	Worm.	Worm drive
Avery B	4,000	2,700	128	Solid..	36.15	Selec..	Dbl chn.	Motor under floor
B. A. Gramm 2	4,000	2,550	146	Solid..	29.00	Ind-c..	Worm...	Worm drive
barker V	4,000	2,400	136	Solid..	25.60	Selec..	Worm...	Worm drive
Bessemer D	4,000	2,300	136	Solid..	27.20	Selec..	Worm...	Worm drive
Blair C1	4,000	2,850	114*	Solid..	27.20	Ind-c..	Worm...	Worm drive
Brasie Twin City	4,000	1,350	104	Solid..	20.00	Plan..	Dbl chn.	Price
Brasie Twin City	4,000	1,350	104	Solid..	22.50	Selec..	Dbl chn.	Price
Brockway I	4,000	1,875	120*	Solid..	27.20	Selec..	Dbl chn.	Wood frame
Coleman G	4,000	2,450	124	Solid..	22.50	Selec..	Dbl chn.	Motor under seats
Curtis	4,000	2,750	130	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Dart	4,000	1,800	130*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Dorris 1A4	4,000	2,500	144*	Solid..	30.65	Selec..	Dbl chn.	Valves in head
Duplex C	4,000	2,800	130	Solid..	27.20	Selec..	Int-g....	4-wheel drive
Four Wheel Drive G	4,000	3,400	124	Solid..	29.00	Selec..	Bevel-4..	4-wheel drive
Fremont-Mais O	4,000	1,700*	132*	Solid..	22.50	Prog..	Int-g....	Int-gear drive
Garford L	4,000	3,000	128*	Solid..	36.15	Selec..	Dbl chn.	Motor betw. seats
G. A. Schacht 2	4,000	2,800	138	Solid..	29.00	Selec..	Worm...	Worm drive
GMC SC	4,000	1,900	143	Solid..	25.60	Selec..	Dbl chn.	Standard car
Gramm 2	4,000	3,600	128	Solid..	32.40	Selec..	Dbl chn.	Motor betw. seats
Horner 2	4,000	$2,650	145	Solid..	27.20	Selec..	Dbl chn	French hood
Hurlburt 2	4,000	3,000	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Jeffery 4015	4,000	2,750	124	Solid..	22.50	Selec..	Int-g-4..	4-wheel drive
Kelly K-35	4,000	2,750	144*	Solid..	22.50	Selec..	Dbl chn.	French hood
Krebs H	4,000	2,350	144*	Solid..	27.20	Selec..	Worm...	Variable governor
Lambert V5	4,000	2,300	120	Solid..	32.40	Fric...	Dbl chn.	Friction drive
Lippard-Stew G	4,000	2,600	158*	Solid..	27.20	Selec..	Worm...	Worm drive
Maccar F	4,000	2,400	150*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Maccar D	4,000	2,400	150*	Solid..	27.20	Selec..	Worm...	Worm drive
Mais E	4,000	2,950	132	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Mais F	4,000	3,000	145	Solid..	25.60	Prog..	Int-g....	Int-gear drive
Moore 2	4,000	2,500	163	Solid..	32.40	Selec..	Dbl chn.	Standard car
Nel. & LeMoon E2	4,000	2,250	Opt...	Solid..	27.20	Selec..	Worm...	Worm drive
Packard 2	4,000	2,800	120*	Solid..	26.39	Prog..	Dbl chn.	Standard car
Paulding M	4,000	1,950	145	Solid..	34.28	Selec..	Dbl chn.	Standard car
Pierce-Arrow 2	4,000	3,000	150*	Solid..	25.60	Selec..	Worm...	Worm drive
Reo J	4,000	1,650	130*	Solid..	27.20	Selec..	Dbl chn.	Knock-down rad.
Rowe DW	4,000	2,800	150	Solid..	29.00	Selec..	Worm...	Worm drive
Sandow 2	4,000	2,250	125*	Solid..	27.20	Selec..	Dbl chn.	Standard car
Sanford L	4,000	1,910	118	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Sanford M	4,000	1,910	140	Solid..	27.20	Selec..	Dbl chn.	Standard car
Service P	4,000	2,375	150	Solid..	27.20	Selec..	Dbl chn.	Standard car
Service PW	4,000	2,500	160	Solid..	27.20	Selec..	Worm...	Worm drive
South Bend 40	4,000	2,000	136*	Pneu*.	26.50	Selec..	Dbl chn.	Standard car
Speedwell 8Y	4,000	2,850	115	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Standard-O C	4,000	2,000	144*	Solid*	25.60	Selec..	Dbl chn.	Standard car
Sternberg	4,000	2,800	148*	Solid..	22.50	Ind-c..	Worm...	Worm drive
Trabold	4,000	2,450	130	Solid..	27.20	Selec..	Worm*..	Worm drive
Transit F	4,000	2,850	144	Solid..	32.40	Selec..	Dbl chn.	Opt. motor locat'n
U. S. E	4,000	2,550	132	Solid..	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Wichita B	4,000	2,100	118	Solid..	19.61	Selec..	Dbl chn.	Standard car
Wilcox NA	4,000	2,500	118	Solid..	29.00	Selec..	Dbl chn.	Motor under floor
Willet L	4,000	2,600	144	Solid..	27.20	Selec..	Dbl chn.	French hood
Wilson B	4,000	1,800	130*	Solid..	27.20	Selec..	Dbl chn.	Standard car

TRUCKS OF 2½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Aetna 2½	5,000	$2,400	158	Solid.	34.28	Selec..	Worm..	Worm drive
Beck	5,000	1,850	130	Solid.	40.00	Selec..	Int-g....	Int-gear drive
Crown C	5,000	3,000	150	Solid..	29.00	Selec..	Worm..	Worm drive
DeKalb D2	5,000	2,450	136	Solid.	27.50	Selec..	Dbl chn	Standard car
Kisselkar 2½	5,000	2,750	144*	Solid.	32.40	Selec..	Dbl chn	Standard car
Kleiber 2	5,000	2,750	150*	Solid.	27.20	Selec..	Dbl chn	Standard car
Lange B	5,000	3,000	136	Solid..	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Lewis 21	5,000	2,900	144	Solid.	29.00	Ind-c..	Dbl chn.	Ind.-clutch gears't
Mais G	5,000	3,200	145	Solid..	29.69	Prog..	Int-g....	Int-gear drive
Martin E	5,000	3,000	135	Solid..	27.20	Selec..	Dbl hn.	Motor under floor
Moreland 2X	5,000	2,650	144	Solid.	32.40	Selec..	Worm..	Distillate fuel
Stegeman	5,000	2,800	142	Solid.	29.00	Selec..	Dbl chn	Chain cases
U. S. G	5,000	2,750	138	Solid..	27.20	Ind-c..	Dbl chn.	Ind.-clutch gears't
Velie	5,000	2,850	148*	Solid.	32.40	Selec.	Dbl chn	Standard car
Vulcan 2	5,000	2,750	150*	Solid.	29.99	Selec..	Dbl chn	English design

TRUCKS OF 3-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A&B 3-T	6,000	......	144	Solid..	42.76	Elec..	Int-g-f..	Gas-electric
Atterbury DW	6,000	$3,800	168	Solid..	32.40	Selec..	Worm...	Worm drive
Avery, A	6,000	2,500c	140	Wood	36.15	Selec..	Dbl chn.	Farm truck
Avery, B	6,000	3,200	128	Solid..	36.15	Selec..	Dbl chn.	Motor under floor
Blair B1	6,000	3,250	120*	Solid..	36.15	Ind-c..	Worm...	Worm drive
Chase O	6,000	3,300	175	Solid..	32.40	Selec..	Worm...	Worm drive
Coleman H	6,000	3,000	134	Solid..	27.20	Selec..	Dbl chn.	Motor under seat
Continental G	6,000	2,700	144	Solid..	16.92	Selec..	Opt....	Standard car
Crawford	6,000	3,000	144	Solid..	32.40	Selec..	Dbl chn.	Standard car
Curtis	6,000	3,250	130	Solid..	27.20	Selec..	Dbl chn.	Motor under floor
Duplex D	6,000	3,200	130	Solid..	29.00	Selec..	Int-g-4..	4-wheel drive
Four Wheel Drive B	6,000	4,000	124	Solid..	36.15	Selec..	Bevel-4..	4-wheel drive
Garford J	6,000	3,500	128*	Solid..	36.15	Selec..	Dbl chn.	Motor betw. seats
G. A. Schacht 3	6,000	3,200	150	Solid..	29.00	Selec..	Worm..	Worm drive
Harvey H	6,000	3,000	168	Solid..	29.00	Selec..	Dbl chn.	Standard car
Horner 3	6,000	3,200	145	Solid..	32.40	Selec..	Dbl chn	French hood
Indiana F	6,000	2,500	144	Solid..	29.00	Selec..	Dbl chn	Standard car

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction, bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

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TRUCKS OF 3-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Lewis 31	6,000	$3,250	144	Solid	29.00	Ind-c	Dbl chn	Opt. motor locat'n
Locomobile 3	6,000	3,500	150*	Solid	29.00	Selec	Worm	Worm drive
Mais H	6,000	3,400	160	Solid	29.69	Prog	Int-g	Int-gear drive
McIntyre G	6,000	.....	144	Solid	27.20	Selec	Dbl chn	Standard
Moore 3	6,000	3,150	142	Solid	32.40	Selec	Dbl chn	Motor under floor
Old Reliable 3	6,000	3,400	122	Solid	29.00	Selec	Dbl chn	Motor under floor
Packard 3	6,000	3,400	126*	Solid	32.40	Prog	Dbl chn	Standard car
Peerless 3	6,000	3,700	151*	Solid	32.40	Selec	Dbl chn	Standard car
Roland 3	6,000	3,500	144	Solid	29.00	Elec	Worm	Gas-electric
Rowe EW	6,000	3,400	156	Solid	25.60	Selec	Worm	Worm drive
Sandow 3	6,000	3,000	147*	Solid	32.40	Selec	Dbl chn	Standard car
Service H	6,000	2,975	171	Solid	29.00	Selec	Dbl chn	Standard car
Standard-D 3	6,000	2,750	144	Solid	32.40	Prog	Worm*	Worm drive opt.
Sternberg	6,000	3,400	158*	Solid	29.00	Ind-c	Worm	Worm drive
Trabold	6,000	3,300	130	Solid	29.00	Selec	Worm*	Worm drive
U. S. D	6,000	3,200	144	Solid	32.40	Ind-c	Dbl chn	Ind.-clutch gears't
Universal A	6,000	3,400	132	Solid	25.60	Selec	Dbl chn	Motor under floor
Ware	6,000	......	......	Solid	25.60	.....	Bevel	4-wheel drive
White TAD	6,000	3,700	163	Solid	22.50	Selec	Dbl chn	Standard car
Wilcox JA	6,000	3,250	128	Solid	29.00	Selec	Dbl chn	Motor under floor
Willet K	6,000	2,800	144	Solid	32.40	Selec	Dbl chn	French hood

TRUCKS OF 3½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
B. A. Gramm 3½	7,000	$3,400	158	Solid	29.00	Ind-c	Worm	Worm drive
Couple-Gear H.C	7,000	4,850	144	Solid	44.20	Elec	Bevel-4	Gas-electric
GMC HU	7,000	2,500	158	Solid	40.00	Prog	Dbl chn	Standard car
Gramm 3½	7,000	4,600	140	Solid	32.40	Selec	Dbl chn	Motor betw. seats
Hurlburt 3½	7,000	3,500	Opt	Solid	29.00	Selec	Worm	Worm drive
Kelly K-40	7,000	3,400	150*	Solid	32.40	Selec	Dbl chn	French hood
King 3½	7,000	3,200	120	Solid	32.40	Ind-c	Dbl chn	Motor under floor
Kisselkar 3½	7,000	3,350	162	Solid	38.25	Selec	Dbl chn	Standard car
Kleiber 3	7,000	3,300	160*	Solid	32.40	Selec	Dbl chn	Standard car
M&E B	7,000	3,350	132	Solid	32.40	Selec	Dbl chn-f	Front drive
Martin L	7,000	3,500	145	Solid	36.15	Selec	Dbl chn	Motor under floor
Moreland 3X	7,000	3,500	168	Solid	36.15	Selec	Worm	Distillate fuel
Roland 3½	7,000	3,500	156	Solid	32.40	Elec	Dbl chn	Gas-electric
Royal B3½	7,000	3,400	132	Solid	36.15	Ind-c	Dbl chn	Motor under floor
Smith A	7,000	3,750	168	Solid	40.00	Ind-c	Worm	Worm drive
Standard-O C	7,000	3,200	162	Solid	30.65	Selec	Dbl chn	Standard car
Stegeman	7,000	3,350	155*	Solid	32.50	Selec	Dbl chn	Chain cases
Transit T	7,000	3,500	144	Solid	32.40	Selec	Dbl chn	Opt. motor locat'n
Vulcan 3	7,500	3,250	156*	Solid	29.99	Selec	Dbl chn	English design
Wichita H	7,000	3,250	165	Solid	29.00	Selec	Dbl chn	Standard car

TRUCKS OF 4-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Blair E1	8,000	$3,750	135*	Solid	36.15	Ind-c	Worm	Worm drive
Dayton A	8,000	2,700	136	Solid	36.15	Selec	Dbl chn	Motor under floor
Garford K	8,000	3,850	128*	Solid	36.15	Selec	Dbl chn	Motor betw. seats
Locomobile 4	8,000	3,650	150*	Solid	29.00	Selec	Worm	Worm drive
Moore 4	8,000	3,500	153	Solid	36.15	Selec	Dbl chn	Motor under floor
Old Reliable 4	8,000	4,000	126	Solid	36.15	Selec	Dbl chn	Motor under floor
Packard 4	8,000	3,500	126*	Solid	32.40	Prog	Dbl chn	Standard car
Peerless 4	8,000	4,000	151*	Solid	32.40	Selec	Dbl chn	Standard car
South Bend 80	8,000	3,000	152	Pneu*	44.20	Selec	Dbl chn	Standard car
Speedwell 10Z	8,000	3,750	115	Solid	40.00	Selec	Dbl chn	Motor under floor
U. S. F	8,000	3,550	156	Solid	32.40	Ind-c	Dbl chn	Ind.-clutch gears't
Velie Z	8,000	3,350	148*	Solid	32.40	Selec	Dbl chn	Standard car

TRUCKS OF 4½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Vulcan 4	9,200	$4,000	162	Solid	29.99	Ind-c	Dbl chn	English design

TRUCKS OF 5-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A & B 5-T	10,000	....	144	Solid	42.76	Elec	Int-g-f	Gas-electric
Atterbury E	10,000	$4,000	153	Solid	38.25	Selec	Dbl chn	Standard car
Avery B	10,000	4,500	128	Solid	44.20	Selec	Dbl chn	Motor under floor
B. A. Gramm 5	10,000	4,300	168	Solid	40.80	Ind-c	Dbl chn	Ind.-clutch gears't
Blair, F	10,000	4,500	135*	Solid	36.15	Ind-c	Worm	Worm drive
Couple-Gear AC	10,000	5,400	144	Solid	53.00	Elec	Bevel-4	Gas-electric
C. T.	10,000	......	155	Solid	25.60	Elec	Dbl red-4	Gas-electric
GMC KU	10,000	3,000	158	Solid	40.00	Prog	Dbl chn	Standard car
Garford D	10,000	4,500	128*	Solid	29.00	Selec	Dbl chn	Motor betw. seats
Gramm 5	10,000	5,350	140	Solid	32.40	Selec	Dbl chn	Motor betw. seats
Horner 5	10,000	4,200	156	Solid	44.20	Selec	Dbl chn	French hood
Indiana K	10,000	3,200	165	Solid	36.15	Selec	Dbl chn	Standard car
Kelly K-50	10,000	4,250	150*	Solid	32.40	Selec	Dbl chn	French hood
Kleiber 5	10,000	4,000	170*	Solid	40.00	Selec	Dbl chn	Standard car
LaFrance 6	10,000	5,500	140	Solid	48.48	Hyd	Dbl chn	Hydraulic drive
Locomobile A2	10,000	4,500	140*	Solid	40.00	Selec	Dbl chn	Motor under floor
M & E G	10,000	2,750	116	Sol-st	29.00	Selec	Dbl chn	Front drive
Moore 5	10,000	4,500	175	Solid	44.20	Selec	Dbl chn	Motor under floor
Moreland 5X	10,000	4,000	168	Solid	36.15	Selec	Dbl chn	Distillate fuel
Old Reliable 5	10,000	4,000	126	Solid	36.15	Selec	Dbl chn	Motor under floor
Packard 5	10,000	4,150	144*	Solid	40.00	Prog	Dbl chn	Standard car
Peerless 5	10,000	4,500	151*	Solid	32.40	Selec	Dbl chn	Standard car
Pierce-Arrow 5	10,000	4,500	168*	Solid	38.25	Selec	Worm	Worm drive
Rowe GW	10,000	4,500	171	Solid	36.15	......	Worm	Worm drive
Royal A5	10,000	4,500	138	Solid	36.15	Ind-c	Dbl chn	Motor under floor
Service HX	10,000	4,000	175	Solid	36.15	Selec	Dbl chn	Standard car
Stegeman	10,000	4,200	168	Solid	32.40	Selec	Dbl chn	Chain cases
Sternberg	10,000	4,500	......	Solid	32.40	Ind-c	Worm	Worm drive
Transit V	10,000	4,500	144*	Solid	32.40	Selec	Dbl chn	Opt. motor locat'n
Velie Z5	10,000	3,750	148*	Solid	32.40	Selec	Dbl chn	Standard car
Walter 5	10,000	4,500	144	Solid	30.65	Selec	Int-g-4	4-wheel drive
White TCD	10,000	4,500	165	Solid	29.00	Selec	Dbl chn	Standard car

TRUCKS OF 5½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Vulcan 5	11,005	$4,500	162	Solid	29.99	Ind-c	Dbl chn	English design

TRUCKS OF 6-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Daimler-Amer. FV	12,000	....	169	Solid	29.00	Selec	Int-g	German design
Four Wheel Drive M	12,000	$4,800	148	Solid	44.20	Selec	Bevel-4	4-wheel drive
Garford F	12,000	4,850	128*	Solid	29.00	Selec	Dbl chn	Motor betw. seats
Kisselkar 6	12,000	4,350	168	Solid	38.25	Selec	Dbl chn	Standard car
Knox-Tractor 31	12,000	3,250	139	Solid	40.00	Selec	Dbl chn	3-wheeler
Locomobile AA2	12,000	4,800	140*	Solid	40.00	Selec	Dbl chn	Motor under floor
Packard 6	12,000	4,300	144*	Solid	40.00	Prog	Dbl chn	Standard car
Peerless 6	12,000	5,000	151*	Solid	32.40	Selec	Dbl chn	Standard car
Smith C	12,000	4,750	168	Solid	44.20	Ind-c	Worm	Worm drive
Speedwell 8X	12,000	4,400	139	Solid	40.00	Selec	Dbl chn	Motor under floor
Sternberg	12,000	4,65[illegible]	144	Solid	36.15	Ind-c	Dbl chn	Motor under floor
Walter 6	12,000	4,750	144	Solid	30.65	Selec	Int-g-4	4-wheel drive

TRUCKS OF 6½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Moreland 6X	13,000	$4,500	168	Solid	44.20	Selec	Dbl chn	Distillate fuel

TRUCKS OF 7-TON CAPACITY AND OVER

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Knox-Tractor 32	20,000	$3,750	149	Solid	40.00	Selec	Dbl chn	3-wheeler
Mais Tractor	16,000	2,750	84	Solid	29.69	Prog	Int-g	Int-gear drive
Old Reliable 7	14,000	5,000	126	Solid	36.15	Selec	Dbl chn	Motor under floor
Standard-D 7	14,000	3,300	112	Solid	32.40	Prog	Dbl chn	Standard car
Sternberg	14,000	4,750	144	Solid	36.15	Ind-c	Dbl chn	Motor under floor
Vulcan 7	15,590	6,000	156*	Solid	36.15	Prog	Dbl chn	English design
Walter 7½	15,000	5,000	144	Solid	38.25	Selec	Int-g-4	4-wheel drive
Walter Tractor	24,000	4,500	108	Solid	38.25	Selec	Int-g-4	4-wheel drive

CAPACITIES NOT GIVEN

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Bulley Tractor	......	3,490	72	Solid	30.65	Selec	Dbl chn	3-wheeler

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction, bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

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Specification of Power Wagons and Trucks

Principal Details of the Mechanical Construction of 377 Different Sizes of by 143 Concerns, and the Features of the

PRACTICALITY of construction undoubtedly appeals to the individual investigating motor vehicles with the intention of purchasing, especially if he has experience in operating pleasure cars. What will facilitate the work of the driver will, all else being equal, perhaps have some weight with the investigator, but the main desideratum is to secure constructions that will endure, for more and more the users of motor trucks and wagons are realizing that endurance is the real factor that makes for power vehicle economy.

There are those who assume that power wagon or truck engineering is in a state of transition—that there is uncertainty as to principles so far as these attract buyers, and that purchasing is dependent upon following different theory and practise. As a matter of fact the industry has really accepted the four-cylinder motor as being that best suited for freight carrying vehicles, unqualifiedly approved water cooling, so that the real difference is in power transmission systems.

Considering pleasure car development for a moment, the fact that practically all productions are shaft driven is obvious. The reason is that the chain drive, to be efficient, requires constant attention, and work in connection with the use of an automobile for pleasure is shirked by owner and driver alike. The chain driven types are, if given good care, at least equal to the shaft-propelled, but the people buying pleasure cars desire to minimize labor.

Regarding motor wagon and truck engineering there is a belief becoming prevalent that the shaft drive can be applied to machines designed for freight carrying just as it has been generally adopted for pleasure cars, for the purpose of better protecting wearing parts and minimizing the labor necessary to keep them efficiently operative. This statement is based on the rapidly increasing number of vehicles that are driven by worm shaft and wheel, or by shaft and internal gearing, these affording the same degree of protection of the driving system that obtains with

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES: Kind	TIRES: Sizes in Inches: Front	TIRES: Sizes in Inches: Rear	MOTOR: Location	Cylinders: No.	Cylinders: Bore in Ins.	Cylinders: Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Cooling: Water Circulation	Cooling: Radiator Type	Ignition: Type	Ignition: Make	Ignition: Spark Advance
A & B 3-T	6,000	4,500	144	Solid	48x3½d	48x3½d	Under hood	4	5.17	4.75	42.76	Pairs	Right	Gear	Finned	Dual	Bosch	Hand
A & B 5-T	10,000	4,750	144	Solid	48x3½d	48x5d	Under hood	4	5.17	4.75	42.76	Pairs	Right	Gear	Finned	Dual	Bosch	Hand
Adams A	2,000	1,850	121*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Adams D	3,000	2,300	121*	Solid	36x3½	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Adams E	4,000	2,500	140*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Aetna 1½	3,000	2,150	158	Solid	36x3½	36x5	Under hood	4	4.00	4.50	25.60	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Aetna 2½	5,000	2,400	158	Solid	36x4	36x3½d	Under hood	4	4.37	6.00	34.28	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Armleder B	2,000	2,200	136	Pneu	40x4	39x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Sing	Bosch	Hand
Armleder H	3,000	2,150	Opt	Solid	40x4	40x6*	Under hood	4	4.50	5.00	32.40	Block	Opp	Cent	Sq-t	Sing	Bosch	Hand
Armleder E	4,000	2,500	Opt	Solid	40x4	40x7*	Under hood	4	4.50	5.00	32.40	Block	Opp	Cent	Sq-t	Sing	Bosch	Hand
Atterbury AW	1,500	1,800	118	Pneu	35x4½	35x4½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Atterbury BW	2,000	2,100	137	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Atterbury CW	4,000	2,800	153	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Atterbury DW	6,000	3,800	168	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Dual-d	Bosch	Hand
Atterbury E	10,000	4,000	153	Solid	36x5	42x6d	Under hood	4	4.87	5.50	38.25	Pairs	Opp	Cent	Finned	Dual	Bosch	Fixed
Auglaize H	1,500	950	100	Solid	36x2½	36x3	Under seat	2	5.25	4.00	22.10	Sing	Head	Thermo	Finned	Dual	Remy	Hand
Auglaize D	1,500	950	100	Solid	36x3½	36x4	Under seat	4	3.75	5.12	22.50	Block	Left	Thermo	Finned	Dual	Remy	Hand
Autocar 21F	3,000	1,850	97	Opt	34x4	34x5	Under seat	2	3.75	4.50	18.10	Sing	Right	Cent	Finned	Sing	Bosch	Fixed
Available	2,000	......	Opt	Solid	36x3	36x3½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Available	4,000	......	Opt	Solid	36x3½	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Avery C	2,000	1,690	128	Solid	34x3½	34x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Heinze	Hand
Avery B	4,000	2,700	128	Solid	36x4	36x3½d	Under floor	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Eisemann	Auto
Avery B	6,000	3,200	128	Solid	38x5	38x4d	Under floor	4	4.75	5.00	36.15	Sing	Left	Cent	Cell	Dual	Eisemann	Auto
Avery A	6,000	2,500c	140	Wood	38x5	38x4d	Betw. seats	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Eisemann	Auto
Avery B	10,000	4,500	128	Solid	38x6	38x5d	Under floor	4	5.25	5.75	44.20	Pairs	Opp	Cent	Cell	Dual	Eisemann	Auto
B. A. Gramm 1	2,000	1,750	130	Solid	34x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Cell	Sing	Bosch	Hand
B. A. Gramm 2	4,000	2,550	146	Solid	36x4	36x3½d	Under hood	4	4.25	5.75	29.00	Pairs	Left	Cent	Cell	Dual	Bosch	Hand
B. A. Gramm 3½	7,000	3,400	158	Solid	36x5	40x5d	Under hood	4	4.25	5.75	29.00	Pairs	Left	Cent	Cell	Dual	Bosch	Hand
B. A. Gramm 5	10,000	4,300	168	Solid	36x6	40x6d	Under hood	6	4.12	5.50	40.80	Threes	Right	Cent	Cell	Dual	Bosch	Hand
Barker U	2,000	2,000	130	Solid	42x3½	42x5	Under hood	4	4.00	5.00	25.60	Block	Left	Thermo	Cell	Sing	Eisemann	Auto
Barker V	4,000	2,400	136	Solid	36x4	36x7	Under hood	4	4.00	5.00	25.60	Block	Left	Thermo	Cell	Sing	Eisenamn	Auto

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price, -c,** *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinders Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *Thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honey-comb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-Pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

Courtesy of The Commercial Vehicle.

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Built This Year by American Manufacturers

Gasoline and Gasoline-Electric Service Vehicles, Including Tractors, Produced Standard Equipment of These Machines.

the pleasure cars. With reasonable lubrication there is minimum wear and maximum endurance, and more generally economical service as compared with chains that are not cleaned and used so as to obtain the greatest degree of efficiency.

Material changes in design are not made if standardization has been the purpose of the manufacturer, because of the large cost necessary for experimental work, patterns, fixtures and machinery, and generally endeavor is directed to perfecting what may appear to be insufficient or unsatisfactory in detail; what will make for greater convenience, for increased accessibility, for simplification, for improved lubrication of moving parts and for compensating wear without renewals of parts or sacrifice of efficiency.

With power plants of motor and clutch, or motor clutch and gearset, or with the gearset a unit with the jackshaft, the driving systems are simple, but there is now a much larger number with a combined engine, clutch and gearset, with worm driven rear axle, than were built a year ago. With worm drive the full floating axle has been adopted by the largest number.

A compilation of motor vehicle manufacturers shows there are now more than 250 concerns producing machines, but not all of these are building commercially, and some of them are practically unknown.

The appended tabulation of specifications is of 377 different vehicles built by 143 concerns, the number produced ranging from one to eight, and examination of these indicate that there is surprising unanimity of engineers in constructional details. There is shown, by comparison with the specifications compiled a year ago, an increase of worm driven machines, to 104 models produced by 43 concerns, and to 24 internal gear driven trucks built by 11 firms. Ten different companies construct 28 models of vehicles driven by four wheels. These specifications show that 49 makers build 88 machines in which the tractive effort and the torque are taken by the forward ends of the rear springs, a practise adopted by many the past year.

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
				Scheb	Circ-spl		Elec	Amid	2	28 -1	Int-gear-f.	R-r	½-Ell	½-Ell	Right	Right	R-r	A & B 3-T
				Scheb	Circ-spl		Elec	Amid	2	28 -1	Int-gear-f.	R-r	½-Ell	½-Ell	Right	Right	R-r	A & B 5-T
Cent	Motor	1,300	15	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Adams A
Cent	Motor	1,200	13	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Adams D
Cent	Motor	1,100	12	Zenith	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Adams E
Cent	D-shft	1,000	15	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	¾-Ell	Left	Cent	Springs	Aetna 1½
Cent	Motor	1,000	14	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	7 -1	Top worm	Springs	½-Ell	¾-Ell	Left	Cent	Springs	Aetna 2½
		1,300	20	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3	5⅔-1	Bevel	T-arm	½-Ell	Ellip	Left	Cent	R-r	Armleder B
		1,300	16	Scheb	Splash	Wet-d	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Armleder H
		1,300	16	Scheb	Splash	Wet-d	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Armleder E
		1,200	22½	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury AW
Cent	Motor	1,200	18¾	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury BW
Cent	Motor	1,200	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	9¼-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Atterbury CW
Cent	Motor	1,200	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	10⅓-1	Top worm		½-Ell	½-Ell	Left	Cent	R-r	Atterbury DW
Cent	Motor	1,200	10	Strom	Circ-spl	Wet-d	Selec	Unit-j	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Atterbury E
L-b	D-shft	1,200	12	Scheb	Circ-spl	Wet-d	Selec	Unit-j	2	8- 1	Bevel	R-r	½-Ell	½-Ell	Right	Right	R-r	Auglaize H
L-b	D-shft	1,000	18	Scheb	Circ-spl	Wet-d	Selec	Unit-j	3	7 -1	Bevel	R-r	½-Ell	½-Ell	Right	Right	R-r	Auglaize D
None	None		20	Strom	Spl-press	Dry-p	Prog	Amid	3	7 -1	Dbl-red	Springs	½-Ell	Plat	Right	Right	Springs	Autocar 21F
Cent	Motor	1,000	16	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Available
Cent	Motor	1,000	14	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Available
Cent	Motor	1,200	15	Ray	Spl-press	Dry-d	Selec	Unit-m	3	7¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Avery C
L-b	Motor	1,200	14½	Ray	Spl-press	Dry-d	Selec	Unit-j	3	3⅓-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,200	13	Ray	Spl-press	Dry-p	Selec	Unit-j	3	3½-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,200	12	Ray	Spl-press	Dry-d	Selec	Unit-j	3	3⅓-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Avery A
Cent	Motor	1,000	10	Scheb	Spl-press	Wet-d	Selec	Unit-j	3	12⅓-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Avery B
Cent	Motor	1,000	16	Scheb	Spl-press	Cone	Selec	Unit-j	3	7 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	B. A. Gramm 1
Cent	Motor	1,000	15	Strom	Spl-press	Dry-d	Ind-c	Amid	3	8⅓-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	B. A. Gramm 2
Cent	Motor	1,100	12	Strom	Spl-press	Dry-d	Ind-c	Amid	4	9½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	B. A. Gramm 3½
Cent	Motor	1,000	10	Strom	Spl-press	Dry-d	Ind-c	Amid	4	11 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	B. A. Gramm 5
None	None	1,500	27	Strom	Spl-press	Dry-p	Selec	Unit-m	4		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Barker U
None	None	1,500	20	Strom	Spl-press	Dry-p	Selec	Unit-m	4		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Barker V

Carbureter Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-ellipitc;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l *gearshift center brake left;* St-col, *steering column.* **Propulsion** R-r *radius rods* ;T-arm *,torque arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES: Kind	TIRES: Sizes in Inches: Front	TIRES: Sizes in Inches: Rear	MOTOR: Location	Cylinders: No.	Cylinders: Bore in Ins.	Cylinders: Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Cooling: Water Circulation	Cooling: Radiator Type	Ignition: Type	Ignition: Make	Ignition: Spark Advance
Bauer..........A	1,000	900	100	Solid....	36x2	36x2	Under hood..	4	3.75	5.00	22.50	Block...	Right...	Cent......	Finned....	Sing.....	Mea......	Hand.....
Bauer..........B	1,500	1,150	110	Solid....	34x3	34x3½	Under hood..	4	3.75	5.00	22.50	Block...	Right...	Cent......	Finned....	Sing.....	Mea......	Hand.....
Beck............	3,000	1,600	130	Solid....	34x3½	38x4	Under hood..	4	4.12	5.25	27.20	Pairs....	R&H....	Gear......	Sq-t......	Dual......	Bosch.....	Hand.....
Beck............	5,000	1,850	130	Solid....	36x5	36x6	Under hood..	4	5.00	6.00	40.00	Pairs....	Opp....	Gear......	Sq-t......	Dual......	Bosch.....	Hand.....
Bessemer.......C	2,000	1,250	108	Solid....	34x3½	34x4	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Finned....	Sing......	Eisemann..	Hand.....
Bessemer.......A	3,000	1,800	136	Solid....	34x4	34x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Thermo...	Finned....	Sing......	Eisemann..	Hand.....
Bessemer.......D	4,000	2,300	136	Solid....	36x4	36x3½d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Thermo...	Finned....	Sing......	Eisemann..	Hand.....
Best...........A	1,200	750	78	Solid*...	32x2*	34x2½*	Under floor..	2	4.50	4.50	16.20	Sing....	Opp....	Thermo...	Finned....	Dual......	Remy......	Auto.....
Blair.........C-1	4,000	2,850	114*	Solid....	34x4	34x3½d	Betw. seats..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Sq-t......	Sing......	Bosch.....	Fixed.....
Blair.........D-1	6,000	3,250	120*	Solid....	36x4	36x4d	Betw. seats..	4	4.75	5.50	36.15	Pairs....	Right...	Cent......	Sq-t......	Dual......	Bosch.....	Fixed.....
Blair.........E-1	8,000	3,750	135*	Solid....	36x5	36x5d	Betw seats..	4	4.75	5.50	36.15	Pairs....	Right...	Cent......	Sq-t......	Dual......	Bosch.....	Fixed.....
Blair...........F	10,000	4,500	135*	Solid....	36x6	36x6d	Betw. seats..	4	4.75	5.50	36.15	Pairs....	Right...	Cent......	Sq-t......	Dual......	Bosch.....	Fixed.....
Brasie......Packet	600	375	100	Pneu....	28x3	28x3	Under hood..	4	2.50	4.00	10.00	Block...	Right...	Thermo...	Cell......	Sing......	Berling....	Hand.....
Brasie....Twin City	4,000	1,350	104	Solid....	34x3	36x3½	Under seat...	2	5.00	5.00	20.00	Sing....	Top....	Thermo...	Cell......	Sing......	K.W......	Hand.....
Brasie....Twin City	4,000	1,350	104	Solid....	34x3	36x3½	Under floor..	4	3.75	4.50	22.50	Pairs....	Right...	Thermo...	Cell......	Sing......	K.W......	Hand.....
Brockway.......G	1,500	1,205	100	Solid....	36x2½	36x3	Under hood..	4	3.50	5.00	19.61	Block...	Left....	Thermo...	Finned....	Sing......	Bosch.....	Fixed.....
Brockway.......H	2,500	1,590	112*	Solid....	36x3	36x4	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Brockway........I	4,000	1,875	120*	Solid....	36x4	36x3½d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Buick.........C-4	1,500	1,150	122	Pneu....	35x5	35x5	Under hood..	4	3.75	5.00	22.50	Pairs....	Head....	Cent......	Finned....	Dual......	Delco.....	Hand.....
Bulley....Tractor	......	3,400	72	Solid....	34x4	38x4d	Under hood..	4	4.37	5.50	30.65	Pairs....	Right...	Cent......	Finned....	Dual......	Remy......	Hand.....
Chase...........S	1,000	750	98	Solid....	36x2	36x2	Under hood..	3	4.12	4.00	2-cycl.	Sing....	2-cy....	Air.......	....	Sing......	Bosch.....	Fixed.....
Chase...........T	1,500	1,500	135	Solid....	36x2½	36x3½	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Chase...........R	3,000	2,200	146*	Solid....	36x3½	36x5	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Chase...........O	6,000	3,300	175	Solid....	36x5	36x5d	Under hood..	4	4.50	5.50	32.40	Pairs....	Left....	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Coleman........D	2,000	1,950	112	Solid....	36x3½	36x4	Under seat...	4	3.75	5.25	22.50	Block...	Left....	Cent......	Z-z-t......	Sing......	Bosch.....	Hand.....
Coleman........G	4,000	2,450	124	Solid....	36x4	36x3½d	Under seat...	4	3.75	5.25	22.50	Block...	Left....	Cent......	Z-z-t......	Sing......	Bosch.....	Hand.....
Coleman........H	6,000	3,000	134	Solid....	36x5	36x5d	Under seat...	4	4.12	5.50	27.20	Pairs....	Right...	Cent......	Z-z-t......	Sing......	Bosch.....	Hand.....
Commerce.......S	1,500	875	107	Pneu....	33x4	33x4	Under hood..	4	3.50	5.00	19.61	Block...	R&H....	Thermo...	Finned....	Sing......	Eisemann..	Fixed.....
Continental......F	3,000	1,700	144	Solid....	36x3½	36x4	Under hood..	4	3.25	4.25	16.92	Block...	Left....	Cent......	Cell......	Dual......	Bosch.....	Hand.....
Continental......G	6,000	2,700	144	Solid....	36x3½	36x4	Under hood..	4	3.25	4.25	16.92	Block...	Left....	Cent......	Cell......	Dual......	Bosch.....	Hand.....
Corbitt.........F	2,500	2,000	130	Solid....	36x3½	40x4	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Cell......	Sing......	Bosch.....	Hand.....
Couple-Gear....HC	7,000	4,850	144	Solid....	36x4d	36x4d	Under floor..	4	5.25	6.00	44.20	Sing....	Opp....	Cent......	Sq-t......	Dual......	Mea......	2-pt.....
Couple-Gear....AC	10,000	5,400	144	Solid....	36x5d	36x5d	Under floor..	4	5.75	6.00	53.00	Sing....	Opp....	Cent......	Sq-t......	Dual......	Mea......	2-pt.....
Crawford..........	6,000	3,000	144	Solid....	37x4	37x4d	Under hood..	4	4.50	5.50	32.40	Pairs....	Left....	Cent......	Cell......	Dual......	Bosch.....	Hand.....
Crown..........A	1,500	2,000	120	Pneu....	34x4	34x4½	Under hood..	4	3.75	5.00	22.50	Block...	Right...	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Crown..........B	3,000	2,500	140	Solid....	34x3½	36x5	Under hood..	4	4.00	5.00	25.60	Block...	Right...	Cent......	Finned....	Sing......	Bosch.....	Fixed.....
Crown..........C	5,000	3,000	150	Solid....	34x4	36x6	Under hood..	4	4.25	5.00	29.00	Pairs....	Opp....	Cent......	Finned....	Sing......	Bosch.....	Hand.....
Curtis..........	4,000	2,750	130	Solid....	36x4	36x3½d	Under floor..	4	4.12	5.25	27.20	Block...	Right...	Thermo...	Finned....	Sing......	Eisemann..	Auto.....
Curtis..........	6,000	3,250	130	Solid....	36x4	36x4d	Under floor..	4	4.12	5.25	27.20	Block...	Right...	Thermo...	Finned....	Sing......	Eisemann..	Auto.....
Daimler, Amer..FV	12,000	......	169½	Solid....	34x5	40x6d	Under hood..	4	4.25	5.90	29.00	Pairs....	Head....	Cent......	Cell......	Sing......	Bosch.....	Fixed.....
Dart...........A	1,000	845	100	Pneu....	32x3½	32x3½	Under hood..	4	3.62	4.00	34.28	Block...	Head....	Thermo...	Cell......	Dual......	Briggs....	Hand.....
Dart...........B	2,000	1,400	114	Solid....	37x3	37x3½	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Cell......	Sing......	Eisemann..	Fixed.....
Dart...........C	4,000	1,800	130*	Solid....	35x4	39x4	Under hood..	4	4.12	5.50	27.20	Block...	Right...	Cent......	Cell......	Sing......	Eisemann..	Fixed.....
Dayton.........U	2,000	1,800	118½	Solid....	36x4	36x3d	Under floor..	4	4.25	5.00	29.00	Pairs....	Opp....	Gear......	Finned....	Dual......	Bosch.....	Hand.....
Dayton.........A	8,000	2,700	136	Solid....	36x5	36x4d	Under floor..	4	4.75	5.50	36.15	Pairs....	Opp....	Gear......	Finned....	Dual......	Bosch.....	Hand.....
Decatur........VI	800	630	102	Pneu....	30x3½	30x3½	Under body..	4	2.75	4.00	12.08	Block...	Right...	Gear......	Finned....	Sing......	Berling....	Fixed.....
Decatur.........C	2,000	1,500	113*	Solid*...	34x3½*	34x4*	Under hood..	4	3.75	5.25	22.50	Block...	Left....	Cent......	Cell......	Sing......	Bosch.....	Fixed.....
DeKalb........D1	3,000	1,950	134	Solid....	34x3½	36x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Finned....	Sing......	Eisemann..	Hand.....
DeKalb........D2	5,000	2,450	136	Solid....	36x4	38x6	Under hood..	4	4.12	5.25	27.50	Block...	Left....	Cent......	Finned....	Sing......	Eisemann..	Fixed.....
Denby..........A	1,500	1,500	120	Solid....	34x3	34x4	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Finned....	Sing......	Eisemann..	Fixed.....
Denby..........B	2,000	1,600	120	Solid....	34x3½	34x5	Under hood..	4	3.50	5.00	19.61	Block...	Right...	Thermo...	Finned....	Sing......	Eisemann..	Fixed.....
Dorris.........IA4	1,500	1,950	132*	Pneu....	36x4½	36x4½	Under hood..	4	4.37	5.00	30.65	Pairs....	Head....	Cent......	Cell......	Dual......	Bosch.....	Hand.....
Dorris.........IA4	4,000	2,500	144*	Solid....	36x3½	36x3½d	Under hood..	4	4.37	5.00	30.65	Pairs....	Head....	Cent......	Finned....	Dual......	Bosch.....	Hand.....
Duplex.........C	4,000	2,800	130	Solid....	35x4	35x4	Under hood..	4	4.12	5.50	27.20	Block...	Right...	Cent......	Finned....	Sing......	Eisemann..	Auto.....
Duplex.........D	6,000	3,200	130	Solid....	35x5	35x5	Under hood..	4	4.25	5.50	29.00	Block...	Right...	Cent......	Finned....	Sing......	Eisemann..	Auto.....
Fargo..........E	1,500	750	100	Solid....	34x2½	34x3	Under body..	2	4.50	6.00	16.20	Sing....	Head....	Thermo...	Z-z-t......	Dual......	Briggs....	Hand.....
Fargo..........F	2,000	1,250	130	Solid....	36x3	36x3½	Under hood..	4	3.75	5.00	22.50	Block...	Right...	Thermo...	Finned....	Dual......	Bosch.....	Hand.....
Federal........GH	3,000	1,800	120*	Solid....	36x3½	36x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Cell......	Sing......	Eisemann..	Fixed.....
Federal...GW-HW	3,000	1,900	120*	Solid....	36x3½	36x5	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Cell......	Sing......	Eisemann..	Fixed.....
Flint...........C	2,000	1,285*	106	Solid*...	34x3*	35x3½*	Under hood..	4	3.75	4.50	22.50	Block...	R&H....	Thermo...	Finned....	Dual......	Remy......	Hand.....
Forschler.......1A	3,000	2,300	124*	Solid....	36x3½	36x3d	Under hood..	4	4.12	5.25	27.20	Block...	Left....	Cent......	Sq-t......	Dual......	Bosch.....	Hand.....
Four Wheel Drive.G	4,000	3,400	124	Solid....	36x4	36x4	Under seat...	4	4.25	5.00	29.00	Pairs....	Opp....	Cent......	Sq-t......	Sing......	Bosch.....	Hand.....
Four Wheel Drive.B	6,000	4,000	124	Solid....	36x6	36x6	Under seat...	4	4.75	5.50	36.15	Pairs....	Opp....	Cent......	Sq-t......	Sing......	Bosch.....	Hand.....
Four Wheel Drive.M	12,000	4,800	148	Solid....	38x5d	38x5d	Under seat...	4	5.25	7.00	44.20	Pairs....	Opp....	Cent......	Sq-t......	Dual......	Bosch.....	Hand.....
Fremont-Mais....O	4,000	1,700*	132*	Solid....	36x3½	36x5	Under hood..	4	3.75	5.50	22.50	Block...	Right...	Cent......	Finned....	Sing......	Eisemann..	Fixed.....

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price, -c,** *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only) *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* **2-pt,** *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive, Motor,** *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
None	None	1,500	25	Scheb	Spl-press	Wet-d	Selec	Unit-m	3	6 -1	Dbl-red	T-arm	½-Ell	Ellip	Left	Cent	R-r	**Bauer A**
None	None	1,500	23	Scheb	Spl-press	Wet-d	Selec	Unit-m	3	6 -1	Dbl-red	T-arm	½-Ell	Ellip	Left	Cent	R-r	**Bauer B**
Hyd	Motor		16	Strom	Splash	Wet-d	Selec	Unit-m	3		Int-gear	Springs	½-Ell	½-Ell	Left	Cent		**Beck**
Hyd	Motor		12	Strom	Splash	Wet-d	Selec	Unit-m	3		Int-gear		½-Ell	½-Ell	Left	Cent		**Beck**
None	None			Ray	Spl-press	Cone	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Bessemer C**
None	None			Ray	Spl-press	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Bessemer A**
Cent	Motor	1,000	14	Ray	Spl-press	Cone	Selec	Amid	3	7½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Bessemer D**
Cent	Motor	800	18	Marvel	Splash	None	Fric	Unit-j	Any	6 -1	Dbl chn		½-Ell	Ellip	Left	St-col	R-r	**Best A**
Cent	Motor	1,100	15	S.U.	Spl-press	Cone	Ind-c	Amid	3	7¾-1	Top worm	Sub-f	½-Ell	½-Ell	Right	Right	R-r	**Blair C-1**
Cent	Motor	1,000	14	S.U.	Spl-press	Cone	Ind-c	Amid	3	8¾-1	Top worm	Sub-f	½-Ell	½-Ell	Right	Right	R-r	**Blair D-1**
Cent	Motor	1,000	13	S.U.	Spl-press	Cone	Ind-c	Amid	3	9¾-1	Top worm	Sub-f	½-Ell	½-Ell	Right	Right	R-r	**Blair E-1**
Cent	Motor	1,200	12	S.U.	Spl-press	Cone	Ind-c	Amid	3	12 -1	Top worm	Sub-f	½-Ell	½-Ell	Right	Right	R-r	**Blair F**
				Mayer	Circ-spl	None	Fric	Unit-j	Any		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	**Brasie Packet**
				Scheb	Spl-press	Wet-d	Plan	Unit-j	2		Dbl chn		½-Ell	½-Ell	Right		R-r	**Brasie Twin City**
				Scheb	Spl-press	Wet-d	Selec	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right		R-r	**Brasie Twin City**
Cent	Motor	1,500	18	Scheb	Circ-spl	Cone	Selec	Unit-j	3	7 -1	Dbl chn		Ellip	Ellip	Left	Cent	R-r	**Brockway G**
Cent	Motor	1,200	15	Scheb	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Brockway H**
Cent	Motor	1,200	15	Scheb	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Brockway I**
Cent	Motor	1,800	25	Marvel	Circ-spl	Cone	Selec	Unit-x	3	6 -1	Bevel	T-arm	½-Ell	Ellip	Left	Cent	T-arm	**Buick C-4**
Cent	Motor	800	12	Strom	Circ-spl	Dry-p	Selec	Unit-j	3	14 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Bulley Tractor**
None	None	750	15	Holley	Fuel-inj	Wet-d	Plan	Amid	2	7¾-1	Dbl chn		Ellip	½-Ell	Left	Cent	R-r	**Chase S**
Cent	Motor	1,200	22	Holley	Spl-press	Dry-p	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Chase T**
Cent	Motor	1,200	18	Holley	Spl-press	Dry-p	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Chase R**
Cent	Motor	1,200	18	Holley	Spl-press	Dry-p	Selec	Unit-m	4	5¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Chase O**
Suct	Motor	1,000	16	Scheb	Spl-press	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	**Coleman D**
Suct	Motor	1,000	14	Scheb	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn		Ellip	Plat	Right	Right	R-r	**Coleman G**
Suct	Motor	1,000	12	Scheb	Spl-press	Cone	Selec	Unit-j	3	9¼-1	Dbl chn		Ellip	Plat	Right	Right	R-r	**Coleman H**
		2,000	25	Holley	Circ-spl	Cone	Selec	Unit-m	3	6 -1	Bevel	Tor-t	½-Ell	½-Ell	Left*	Cent	Springs	**Commerce S**
Cent	Motor	1,200		Strom	Circ-spl	Cone	Selec		3		Opt		½-Ell	½-Ell	Right	Right	R-r	**Continental F**
Cent	Motor	1,200		Strom	Circ-spl	Cone	Selec		3		Opt		½-Ell	½-Ell	Right	Right	R-r	**Continental G**
Cent	Motor	1,100	16	Strom	Circ-spl	Wet-d	Selec	Unit-j	3	6¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Corbitt F**
Cent	Motor	1,200	15	Strom	Circ-spl	None	Elec	Unit-m	5	25-1	Bevel-4	Springs	½-Ell	½-Ell	Right	Cent	R-r	**Couple-Gear HC**
Cent	Motor	1,000	12	Strom	Circ-spl	None	Elec	Unit-m	5	25-1	Bevel-4	Springs	½-Ell	½-Ell	Right	Cent	R-r	**Couple-Gear AC**
Suct	Motor	2,000	15	Strom	Circ-spl	Cone	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right		R-r	**Crawford**
Cent	Motor	1,050	20	Strom	Splash	Cone	Selec	Amid	4		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Crown, A**
Cent	Motor	1,050	15	Strom	Circ-spl	Cone	Selec	Amid	4		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Crown, B**
Cent	Motor	1,050	12	Strom	Circ-spl	Cone	Selec	Amid	4		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Crown, C**
Cent	Motor	1,500		Excel	Spl-press	Cone	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Curtis**
Cent	Motor	1,500		Excel	Spl-press	Cone	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Curtis**
Cent	Motor	850	10	Daimler	Spl-press	R-cone	Selec	Amid	4	9½-	Int-gear	T-arm	½-Ell	½-Ell	Right	Right	R-r	**Daimler, Amer. FV**
None	None	1,400	23	Strom	Splash	Cone	Selec	Unit-x	3	6 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	**Dart A**
None	None	1,200	20	Strom	Splash	Dry-d	Selec	Unit-m	3	Opt	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Dart B**
None	None	1,100	15	Strom	Splash	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Dart C**
			16	Opt	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Dayton U**
			12	Opt	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Dayton A**
None	None		30	Zephyr	Circ-spl	Cone	Selec	Unit-x	3	5½-1	Sing chn		½-Ell	T-Ell	Left	Cent	R-r	**Decatur VI**
None	None	2,000	25	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	7¼-1	Int-gear	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Decatur C**
Cent	Motor	888	14	Strom	Spl-press	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**DeKalb D1**
Cent	Motor	750	12	Strom	Spl-press	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**DeKalb D2**
Cent	Motor	1,317	18	Strom	Spl-press	Dry-d	Selec	Unit-m	3	7½-1	Int-gear	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Denby A**
Cent	Motor	1,317	18	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Int-gear	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Denby B**
Suct	Motor	1,375	25	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	4 -1	Bevel	T-arm	½-Ell	Plat	Left	Cent	Springs	**Dorris IA4**
Suct	Motor	946	15	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Dorris IA4**
Cent	Duplex	1,400	12	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	8 -1	Int-gear-4	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Duplex C**
Cent	Dulpex	1,400	12	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	8 -1	Int-gear-4	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Duplex D**
None	None	1,000	20	Scheb	Splash	None	Fric	Amid	Any	4 -1	Bevel	T-arm	½-Ell	Plat	Left	Cent	Springs	**Fargo E**
			18	Ray	Circ-spl	Cone	Selec	Unit-m	3	6 -1	Doub-r	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Fargo F**
Cent	Motor	1,120	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Federal GH**
Cent	Motor	1,190	15	Strom	Circ-spl	Cone	Selec	Amid	3	8½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	R-r	**Federal GW-HW**
Cent	Motor	1,100	20	Marvel	Circ-spl	Cone	Selec	Amid	3	7 -1	Doub-r	T-arm	½-Ell	½-Ell	Left	Cent	T-arm	**Flint C**
Cent	Motor	1,200	15	Carter	Spl-press	Cone	Selec	Unit-j	3		Dbl chn		Comb	Comb	Left	Cent	R-r	**Forschler IA**
Cent	Motor	1,000	14	Strom	Spl-press	Wet-d	Selec	Amid	3	9¾-1	Bevel-4	T-arm	½-Ell	Plat	Right	Right	Springs	**Four Wheel Drive G**
Cent	Motor	1,000	14	Strom	Spl-press	Wet-d	Selec	Amid	3	9 -1	Bevel-4	T-arm	½-Ell	Plat	Right	Right	Springs	**Four Wheel Drive B**
Cent	Motor	1,000	10	Strom	Spl-press	Wet-d	Selec	Amid	3	12¾-1	Bevel-4	T-arm	½-Ell	Plat	Right	Right	Springs	**Four Wheel Drive M**
None	None			Holley	Circ-spl	Cone	Prog	Unit-m	3	8 -1	Int-gear	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Fremont-Mais C**

Carbureter Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-ellipitc;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-ellintic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l *gearshift center brake left;* St-col, *steering column.* **Propulsion** R-r *radius rods,* T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES Kind	TIRES Sizes in Inches Front	TIRES Sizes in Inches Rear	MOTOR Location	CYLINDERS No.	CYLINDERS Bore in Ins.	CYLINDERS Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING Water Circulation	COOLING Radiator Type	IGNITION Type	IGNITION Make	IGNITION Spark Advance
Gabriel K	1,000	1,200	112	Pneu	32x4	32x4	Under hood	4	3.50	5.00	19.61	Block	R&H	Cent	Z-z-t	Sing	Bosch	Fixed
Gabriel H	1,500	1,600	126	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Gabriel M	3,000	2,300	144	Pneu	36x5	36x5d	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Garford L	4,000	3,000	128*	Solid	36x5	40x3½d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford J	6,000	3,500	128*	Solid	36x5	40x4d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford K	8,000	3,850	128*	Solid	36x5	40x5d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford D	10,000	4,500	128*	Solid	36x6	40x6d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford F	12,000	4,850	128*	Solid	36x6	40x7d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
GASchacht 2	4,000	2,800	138	Solid	38x3½	40x3½d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell	Sing	Eisemann	Hand
GASchacht 3	6,000	3,200	150	Solid	38x4	40x4d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell	Sing	Eisemann	Hand
Geneva B	1,500	700	96	Solid	34x2	36x2½	Under hood	2	5.12	4.50	21.10	Sing		Gear	Finned	Sing	Opt	Fixed
GMC 15	1,500	1,090	122	Pneu	35x5	35x5	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Finned	Sing	Eisemann	Hand
GMC VC	2,500	1,500	126	Solid	34x3	36x5	Under hood	4	3.50	5.25	19.61	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC SC	4,000	1,900	143	Solid	34x4	36x3½d	Under hood	4	4.00	6.00	25.60	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC HU	7,000	2,500	158	Solid	36x5	42x5d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
GMC KU	10,000	3,000	158	Solid	36x6	42x6d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
Gramm 1½	3,000	2,600	129	Solid	34x3½	38x5	Betw. seats	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 2	4,000	3,600	128	Solid	36x4	36x3½d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 3½	7,000	4,600	140	Solid	36x5	36x5d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 5	10,000	5,350	140	Solid	36x5	40x6d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Harvey F	3,000	1,800	130	Solid	34x3½	38x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Eisemann	Auto
Harvey H	6,000	3,000	168	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Left	Cent	Z-z-t	Sing	Eisemann	Auto
Herner 1	2,000	2,000	145	Solid	34x3½	34x4	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 1½	3,000	2,250	145	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 2	4,000	2,650	145	Solid	36x4	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 3	6,000	3,200	145	Solid	36x5	40x4d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Herner 5	10,000	4,200	156	Solid	38x6	42x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Gear	Finned	Dual	Bosch	Hand
Hupmobile HT	800	850	106	Pneu	33x4	33x4	Under hood	4	3.25	5.50	16.92	Block	Left	Thermo	Cell	Sing	Bosch	Hand
I. H. C. M	1,000	......	90	Solid	42x2	42x2	Underseat	2	4.50	5.00	16.20	Sing	Head	Cent	Finned	Dual	Heinze	Hand
Independent F	1,500	1,285	112*	Solid	36x3	36x3	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Z-z-t	Sing	Mea	Hand
Independent E	3,000	1,850	122*	Solid	36x3½	36x5	Under hood	4	3.75*	5.25	22.50	Block	Left	Cent	Z-z-t	Sing	Mea	Hand
Indiana B	3,000	1,800	135	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Dual	Bosch	Hand
Indiana F	6,000	2,500	144	Solid	36x4	36x3½d	Under hood	4	4.25	5.25	29.00	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Indiana K	10,000	3,200	165	Solid	36x5	40x4d	Under hood	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Jeffery 1515	1,500	1,300	118	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery 3015	3,000	1,650	130	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery 4015	4,000	2,750	124	Solid	36x5	36x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Z-z-t	Dual	Bosch	Hand
Kalamazoo B	3,000	1,590	126	Solid	37x3½	37x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Bosch	Hand
Kelly K-30	2,000	2,000	120*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Sing	Eisemann	Auto
Kelly K-35	4,000	2,750	144*	Solid	36x4	36x4d	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Sing	Eisemann	Auto
Kelly K-40	7,000	3,400	150*	Solid	38x5	38x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Kelly K-50	10,000	4,250	150*	Solid	38x6	40x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
King 3½	7,000	3,200	120	Solid	36x5	36x5d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch	2-pt
Kisselkar 1500	1,500	1,500	125	Pneu	35x4½	35x4½	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 1	2,000	1,850	140	Pneu	37x5	37x5	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 1½	3,000	2,100	132*	Solid	34x3½	38x5	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 2½	5,000	2,750	144*	Solid	36x4	38x4d	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 3½	7,000	3,350	162	Solid	36x5	40x5d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 6	12,000	4,350	168	Solid	36x6	40x6d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kleiber 1	3,000	2,000	140*	Solid	36x3½	36x5d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 2	5,000	2,750	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 3	7,000	3,300	160*	Solid	36x4½	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 5	10,000	4,000	170	Solid	36x5	40x6d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Z-z-t	Dual	Bosch*	Hand*
Knox Tractor 31	12,000	3,250	139	Solid	34x5	36x5d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell	Dual-d	Bosch	Hand
Knox Tractor 32	20,000	3,750	140	Solid	34x5	38x6d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell	Dual-d	Bosch	Hand
Koehler 1	2,000	725	90	Solid	36x2½	36x2½	Under body	2	5.25	4.00	22.10	Sing	Top	Thermo	Finned	Sing		Fixed
Kosmath 14	1,000	850	110	Pneu	32x3½	34x4	Under hood	4	3.50	4.00	19.61	Pairs	Right	Cent	Finned	Sing	Eisemann	Fixed
Krebs G	2,000	1,900	118	Solid	34x3½	34x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Auto
Krebs H	4,000	2,350	144*	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Auto
LaFrance 6	10,000	5,500	140	Solid	36x5	38x6d	Under hood	4	5.50	6.00	48.48	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Lambert V1	800	900	106	Pneu	30x3½	31x4	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell	Sing	Bosch	Fixed
Lambert V2	1,500	1,125	114	Pneu.*	33x4*	33x4½*	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell	Sing	Bosch	Fixed
Lambert V3	2,000	......	120	Solid	36x3	36x3½	Under hood	4	4.06	4.50	26.27	Block	Left	Cent	Cell	Dual	Briggs	Hand
Lambert V4	3,000	1,900	120	Solid	36x4½	36x4	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell	Dual	Briggs	Hand
Lambert V5	4,000	2,200	120	Solid	36x4	36x5	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell	Dual	Briggs	Hand
Lange C	3,000	2,250	125	Solid	36x3½	38x4	Under hood	4	3.75	5.25	22.50	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lange B	5,000	3,000	136	Solid	36x4	38x6	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lewis 21	5,000	2,900	144	Solid	34x3½	36x3½d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis 31	6,000	3,250	144	Solid	34x4	36x5d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis 51	10,000	4,400	144*	Solid	36x6	38x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear.* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Double, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Dav-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd. *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h				Type	Location	Speeds									
....	....	....	30	Opt	Spl-press	Cone	Selec	Unit-m	3	4 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel** K
....	....	....	35	Strom	Spl-press	Cone	Selec	Amid	3	4¼-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel** H
....	....	....	20	Strom	Spl-press	Cone	Selec	Amid	4	8 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel** M
Cent	Motor	1,140	14¾	Own	Spl-press	Cone	Selec	Unit-j	3	9⅛-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Garford** L
Cent	Motor	1,140	12⅔	Own	Spl-press	Cone	Selec	Unit-j	3	10¾	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Garford** J
Cent	Motor	1,140	10¾	Own	Spl-press	Cone	Selec	Unit-j	3	12½-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Garford** K
Cent	Motor	1,140	10¼	Own	Spl-press	Cone	Selec	Unit-j	4	13⅓-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Garford** D
Cent	Motor	1,140	8⅔	Own	Spl-press	Cone	Selec	Unit-j	4	15⅝-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Garford** F
Cent	Motor	1,000	15	Scheb	Spl-press	Cone	Selec	Amid	3	7¾-1	Top-worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht** 2
Cent	Motor	1,000	12	Scheb	Spl-press	Cone	Selec	Amid	3	9⅔-1	Top worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht** 3
....	....	....	18	Scheb	Spl-press	Wet-d	Plan	Unit-j	2	8 -1	Dbl chn	....	½-Ell	Ellip	Right	Right	R-r	**Geneva** B
Suct	Motor	1,150	20	Marvel	Spl-press	Cone	Selec	Amid	3	6 -1	Bevel	R-r	½-Ell	Ellip	Left	Cent	R-r	**GMC** 15
Cent	Motor	1,130	14	King	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**GMC** VC
Cent	Motor	900	12	King	Spl-press	Cone	Selec	Unit-j	3	8 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**GMC** SC
Cent	Motor	800	11	Marvel	Spl-press	Wet-d	Prog	Unit-j	3	9 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**GMC** HU
Cent	Motor	800	8½	Marvel	Spl-press	Wet-d	Prog	Unit-j	3	12 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**GMC** KU
Cent	Motor	....	....	Opt	Circ-spl	Cone	Selec	Unit-j	3	....	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Gramm** 1½
Cent	Motor	....	....	Opt	Circ-spl	Cone	Selec	Unit-j	3	....	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Gramm** 2
Cent	Motor	....	....	Opt	Circ-spl	Cone	Selec	Unit-j	3	....	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Gramm** 3½
Cent	Motor	....	....	Opt	Circ-spl	Cone	Selec	Unit-j	3	....	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Gramm** 5
L-b	Motor	1,000	16	Holley	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Harvey** F
L-b	Motor	900	10	Holley	Circ-spl	Cone	Selec	Unit-j	4	10¾-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Harvey** H
Cent	Motor	1,200	19	Strom	Circ-spl	Dry-d	Selec	Amid	3	6¾-1	Dbl chn	....	½-Ell	Plat	Left	Cent	R-r	**Horner** 1
Cent	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	7 -1	Dbl chn	....	½-Ell	Plat	Left	Cent	R-r	**Horner** 1½
Cent	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	9½-1	Dbl chn	....	½-Ell	Plat	Left	Cent	R-r	**Horner** 2
Cent	Motor	1,140	12	Strom	Circ-spl	Dry-d	Selec	Amid	3	9⅝-1	Dbl chn	....	½-Ell	Plat	Left	Cent	R-r	**Horner** 3
Cent	Motor	1,000	10	Strom	Circ-spl	Dry-d	Selec	Amid	3	13⅝-1	Dbl chn	....	½-Ell	Plat	Left	Cent	R-r	**Horner** 5
Cent	Motor	1,500	20	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	4 -1	Bevel	Tor-t	½-Ell	Plat	Right	Cent	Tor-t	**Hupmobile** HT
....	....	....	....	Scheb	Spl-press	Cont-b	Ind-c	Unit-m	2	9⅛-1	Dbl chn	....	Ellip	Ellip	Right	Right	R-r	**I. H. C.** M
Cent	Motor	1,350	18	Zephyr	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Independent** F
Cent	Motor	1,200	15	Zephyr	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn	....	½-Ell	Plat	Right	Right	R-r	**Independent** E
L-b	D-shft	1,200	17½	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	7¼-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Indiana** B
L-b	D-shft	1,200	15½	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	8⅓-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Indiana** F
L-b	D-shft	1,200	14⅝	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	9¾-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Indiana** K
Suct	Motor	1,100	22	Strom	Spl-press	Dry-p	Selec	Amid	3	4 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	**Jeffery** 1515
Suct	Motor	1,100	15	Strom	Spl-press	Dry-p	Selec	Unit-j	3	7⅛-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Jeffery** 3015
Suct	Motor	1,100	14½	Strom	Spl-press	Dry-p	Selec	Amid	4	7¾-1	Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Jeffery** 4015
Cent	D-shft	1,600	15	Scheb	Circ-spl	Cone	Selec	Unit-j	3	....	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kalamazoo** B
L-b	Motor	1,200	15	Breeze	Pressure	Cone	Selec	Amid	3	8⅝-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kelly** K-30
L-b	Motor	1,200	11½	Breeze	Pressure	Cone	Selec	Amid	3	11⅓-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kelly** K-35
L-b	Motor	900	9¾	Ray	Pressure	Cone	Selec	Amid	3	11 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kelly** K-40
L-b	Motor	900	8⅝	Ray	Pressure	Cone	Selec	Amid	3	12⅓-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kelly** K-50
Cent	Motor	950	12	Scheb	Circ-spl	Dry-d	Ind-c	Unit-j	3	8⅔-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**King** 3½
Cent	Motor	1,200	25	Strom	Circ-spl	Cone	Selec	Amid	3	5 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar** 1500
Cent	Motor	1,200	25	Strom	Circ-spl	Cone	Selec	Amid	4	4⅛-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar** 1
Cent	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	4	8 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar** 1½
Cent	Motor	1,200	12	Strom	Circ-spl	Cone	Selec	Unit-j	4	10 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar** 2½
Cent	Motor	1,200	11	Strom	Circ-spl	Cone	Selec	Unit-j	4	11 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar** 3½
Cent	Motor	1,200	10	Strom	Circ-spl	Cone	Selec	Unit-j	4	12¾-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar** 6
Cent	Motor	1,200	18	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	7 -1*	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	**Kleiber** 1
Cent	Motor	1,200	16	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1*	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	**Kleiber** 2
Cent	Motor	1,100	14	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9 -1*	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	**Kleiber** 3
Cent	Motor	1,000	12	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1*	Dbl chn	....	½-Ell	½-Ell	Right	Cent	R-r	**Kleiber** 5
Cent	Motor	1,100	12	Strom	Pressure	Dry-p	Selec	Amid	3	11 -1	Dbl chn	....	½-Ell	Cant	Right	Cent	R-r	**Knox Tractor** 31
Cent	Motor	1,100	10½	Strom	Pressure	Dry-p	Selec	Unit-j	3	12⅛-1	Dbl chn	....	½-Ell	Cant	Right	Cent	R-r	**Knox Tractor** 32
....	....	....	20	King	Splash	Cone	Plan	Unit-j	2	8 -1*	Dbl chn	....	½-Ell	Ellip	Left	Cent	R-r	**Koehler** 1
....	....	1,100	25	Holley	Splash	Cone	Selec	Unit-m	3	4 -1	Bevel	R-r	½-Ell	Ellip	Left	....	R-r	**Kosmath** 14
Cent	Motor	1,025	15	Scheb	Circ-spl	Cone	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs** G
Cent	Motor	1,100	15	Scheb	Circ-spl	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs** H
Cent	Motor	1,200	12	Scheb	Spl-press	None	Hyd	Unit-j	Any	10⅝-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**LaFrance** 6
....	....	....	....	Excel	Spl-press	None	Fric	Amid	Any	3¾-1	Sing chn	....	½-Ell	Ellip	Right	Right	R-r	**Lambert** V1
....	....	....	....	Excel	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Lambert** V2
....	....	....	....	Scheb	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Lambert** V3
Suct	Motor	800	10	Scheb	Spl-press	None	Fric	Amid	Any	10¼-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Lambert** V4
Suct	Motor	800	9	Scheb	Spl-press	None	Fric	Amid	Any	10¼-1	Dbl chn	....	½-Ell	½-Ell	Right	Right	R-r	**Lambert** V5
Cent	Motor	1,250	18	Strom	Circ-spl	Wet-d	Ind-c	Unit-j	3	8 -1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Lange** C
Cent	Motor	1,250	15	Strom	Circ-spl	Wet-d	Ind-c	Unit-j	3	9¼-1	Dbl chn	....	½-Ell	½-Ell	Left	Cent	R-r	**Lange** B
Cent	Motor	1,200	14	Ray	Spl-press	Wet-d	Ind-c	Amid	3	8 -1	Dbl chn	....	½-Ell	Plat	Right	Right	R-r	**Lewis** 21
Cent	Motor	1,200	12	Ray	Spl-press	Wet-d	Ind-c	Amid	3	8¾-1	Dbl chn	....	½-Ell	Plat	Right	Right	R-r	**Lewis** 31
Cent	Motor	1,000	10	Ray	Spl-press	Wet-d	Ind-c	Amid	3	10¼-1	Dbl chn	....	½-Ell	Plat	Right	Right	R-r	**Lewis** 51

Carbureter Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication**, Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type**, Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type**, Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location**, Amid *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive**, Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque**, R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs**, Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering**, Cent, *center.* **Levers**, Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left,* St-col, *steering column.* **Propulsion**, R-r, *radius rods;* T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES: Kind	TIRES: Sizes in Inches: Front	TIRES: Sizes in Inches: Rear	MOTOR: Location	Cylinders: No.	Cylinders: Bore in Ins.	Cylinders: Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Cooling: Water Circulation	Cooling: Radiator Type	Ignition: Type	Ignition: Make	Ignition: Spark Advance
Lippard-Stew. B*	1,500	1,650	115*	Pneu	35x4½	35x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. BW*	1,500	1,775	115*	Pneu	35x4½	35x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. H	2,000	2,000	145	Solid	36x3	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. F	3,000	2,300	145*	Solid	36x3½	36x3d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. G	4,000	2,600	158*	Solid	36x4	36x4d	Under hood	4	4.15	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Little Giant H	2,000	1,350	110	Solid	37x3	37x3½	Under floor	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Dual	King	Hand
Locomobile A2	10,000	4,500	140*	Solid	40x6	40x6d	Under floor	4	5.00	6.00	40.00	Pairs	Opp	Cent	Cell	Dual	Bosch	Hand
Locomobile AA2	12,000	4,800	140*	Solid	40x7	40x7d	Under floor	4	5.00	6.00	40.00	Pairs	Opp	Cent	Cell	Dual	Bosch	Hand
M&E B	7,000	3,500	132	Solid	36x6	36x5d	Under hood	4	4.50	5.50	32.40	Block	Right	Cent	Sq-t	Double	Bosch	Hand
M&E G	10,000	2,750	116	Sol-st	36x5d	40x6	Under hood	4	4.25	5.25	29.00	Pairs	Right	Cent	Sq-t	Double	Bosch	Hand
Maccar B	2,000	1,900	138*	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar E	2,000	1,900	138*	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar C	3,000	2,150	150*	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar F	4,000	2,400	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar D	4,000	2,400	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
McIntyre E	1,500	......	120	Solid	34x3	34x3½	Under hood	4	3.75	5.00	22.50	Block	Right	Thermo	Cell	Sing	Bosch	Hand
McIntyre A	3,000	......	144	Solid	34x3½	36x3d	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Cell	Sing	Bosch	Hand
McIntyre G	6,000	......	144	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Cell	Sing	Bosch	Hand
Mais C	3,000	2,750	119	Solid	37x4	37x5	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais D	3,000	2,800	132	Solid	37x4	37x5	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais E	4,000	2,950	132	Solid	37x4	37x4d	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais F	4,000	3,000	145	Solid	37x4	37x4d	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais G	5,000	3,200	145	Solid	37x5	37x4d	Under hood	4	4.31	5.25	29.69	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais H	6,000	3,400	160	Solid	37x5	37x5d*	Under hood	4	4.31	5.25	29.69	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais Tracter	16,000	2,750	84	Solid	37x4	37x7	Under hood	4	4.31	5.25	29.69	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Martin R	2,000	2,050	125	Solid	36x3½	36x4	Under hood	4	4.00	5.00	25.60	Block	Left	Cent	Finned	Dual	Remy	Hand
Martin S	3,000	2,150	121	Solid	36x3½	40x4	Under floor	4	4.00	5.00	25.60	Block	Left	Cent	Finned	Dual	Remy	Hand
Martin E	5,000	3,000	135	Solid	36x4	40x3½d	Under floor	4	4.25	5.00	27.20	Pairs	Opp	Cent	Finned	Dual	Remy	Hand
Martin L	7,000	3,500	145	Solid	36x5	40x4d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Finned	Dual	Remy	Hand
Menominee A3	1,500	1,125	112	Solid	33x3½	33x3½	Under hood	4	3.75	4.50	22.50	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Menominee B3	2,000	1,400	122	Solid	34x3½	34x4	Under hood	4	4.00	5.00	25.60	Pairs	Left	Thermo	Finned	Dual	Bosch	Hand
Menominee C	3,000	1,800	130	Solid	36x4	36x5	Under hood	4	4.00	5.00	25.60	Pairs	Left	Thermo	Finned	Dual	Bosch	Hand
Mercury P	1,000	.....	84	Solid	38x2	40x2	Under floor	2	4.25	4.00	14.50	Sing	Opp	Air	....	Dual	Remy	Fixed
Modern L	2,000	1,750	136	Solid*	36x3½	36x3½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Dual	Bosch	Hand
Modern H	3,000	1,950	136*	Solid	36x4	36x5*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Cell	Dual	Bosch	Hand
Modern M	3,000	2,000	136*	Solid	36x4	36x5*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Cell	Dual	Bosch	Hand
Moon B	3,000	1,800	125*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Gear	Cell	Dual	Remy	Hand
Moore 1½	3,000	1,950	145	Solid	37x3½	37x4	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 2	4,000	2,500	163	Solid	37x4	37x3½d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 3	6,000	3,150	142	Solid	37x5	37x4d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 4	8,000	3,500	153	Solid	37x5	37x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Moore 5	10,000	4,500	175	Solid	37x6	42x6d	Under floor	4	5.25	7.00	44.20	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Moreland 7X	1,500	1,800	126	Solid*	34x3½	34x3½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	West	Hand
Moreland 1X	3,000	2,050	120	Solid	34x3½	34x5	Under floor	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	West	Hand
Moreland 2X	5,000	2,650	144	Solid	34x4	34x4d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Sing	West	Hand
Moreland 3X	7,000	3,500	168	Solid	36x5	38x5d	Under floor	4	4.75	5.75	36.15	Pairs	Left	Cent	Finned	Sing	West	Hand
Moreland 5X	10,000	4,000	168	Solid	36x6	40x6d	Under floor	4	4.75	6.75	36.15	Pairs	Left	Cent	Finned	Sing	West	Hand
Moreland 6X	13,000	4,500	168	Solid	36x5	40x6d	Under floor	4	5.25	7.00	44.20	Pairs	Opp	Cent	Finned	Sing	Bosch	Hand
Motokart 1&2	500	365	69	Pneu	26x2½	26x2½	Under seat	2	3.62	4.00	10.53	Sing	Head	Thermo	Sq-t	Sing	None	Hand
Natco 20	2,000	1,925	104	Solid	36x3½	36x3½	Betw seats	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	U & H	Fixed
Nelson&LeM. E1	2,000	1,800	Opt	Solid	36x3	36x4	Under hood	4	3.75	5.25	22.50	Block	L&H	Cent	Finned	Dual	Bosch	Fixed
Nelson&LeM. E1½	3,000	2,000	Opt	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Finned	Dual	Bosch	Hand
Nelson&LeM. E2	4,000	2,250	Opt	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Finned	Dual	Bosch	Hand
Netco C	3,000	2,250	144	Solid	36x3½	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
New York L	3,000	2,000	129	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Bosch	Fixed
O. K. C&D	1,200	875	112	Pneu	33x4	33x4	Under hood	4	3.50	5.00	19.61	Block	R&H	Thermo	Z-z-t	Sing	Bosch	Fixed
Old Hickory 30W	3,000	1,900	110	Solid	33x3½	33x4	Under floor	4	3.75	5.00	22.50	Block	Right	Thermo	Z-z-t	Dual	Heinze	Hand
Old Reliable 1½	3,000	2,250	138	Solid	34x3½	36x6	Under hood	4	3.75	5.00	22.50	Block	Left	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 2	4,000	2,750	120	Solid	34x4	36x4d	Under floor	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 3	6,000	3,400	122	Solid	34x5	36x5d	Under floor	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 4	8,000	4,000	126	Solid	36x5	36x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 5	10,000	4,500	126	Solid	36x6	36x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 7	14,000	5,000	126	Solid	36x6	40x7d	Under floor	4	4.75	6.75	36.15	Pairs	Left	Cent	Sq-t	Sing*	Bosch	Hand
Overland 81	800	850-c*	106	Pneu	33x4	33x4	Under hood	4	4.00	4.50	25.60	Sing	Left	Thermo	Sq-t	Sing	Split	Hand
Packard 2	4,000	2,800	120*	Solid	34x3½	34x4d	Under hood	4	4.06	5.12	26.39	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 3	6,000	3,400	126*	Solid	36x4	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 4	8,000	3,550	126*	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 5	10,000	4,150	144*	Solid	36x6	40x6d	Under hood	4	5.00	5.50	40.00	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 6	12,000	4,300	144*	Solid	36x6	42x7d	Under hood	4	5.00	5.50	40.00	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Palmer-Moore D	2,000	1,300	102	Solid	36x2½	36x3	Under hood	3	4.00	4.00	......	Sing	2-cy	Thermo	Finned	Sing	Bosch	Fixed
Paulding O	800	650	95	Pneu	30x3	31x3½	Under hood	4	2.75	4.00	12.08	Block	R&H	Thermo	Finned	Dual	Day-D	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
Cent	Motor	1,230	25	Opt	Spl-press	Cone	Selec	Amid	3	5½-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew. B*
Cent	Motor	1,230	25	Opt	Spl-press	Cone	Selec	Amid	3	6 -1	Top worm	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew. BW*
Cent	Motor	1,134	18	Opt	Spl-press	Cone	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew. H
Cent	Motor	1,300	18	Opt	Spl-press	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew. F
Cent	Motor	1,295	15	Opt	Spl-press	Cone	Selec	Amid	3	9½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew. G
		1,200	12	Holley	Circ-spl	Wet-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Little Giant H
Ring	Motor	900	10½	Own	Spl-press	Dry-d	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Locomobile A2
Ring	Motor	900	10½	Own	Spl-press	Dry-d	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Locomobile AA2
			15	Strom	Circ-spl	Wet-d	Selec	Unit-j	3	12 -1	Dbl chn-f		½-Ell	½-Ell	Left	Cent	R-r	M&E B
			10	Strom	Circ-spl	Wet-d	Selec	Unit-m	3	14 -1	Dbl chn-f		½-Ell	½-Ell	Right	Right	R-r	M&E G
Cent	Motor	1,000	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar B
Cent	Motor	1,000	16	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Maccar E
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar C
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	8 -1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar F
Cent	Motor	1,000	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Maccar D
None	None	1,500	15	Scheb	Circ-spl	Cone	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	McIntyre E
Suct	Motor	1,500	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	McIntyre A
Suct	Motor	1,500	6	Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	McIntyre G
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais C
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais D
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais E
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais F
L-b	Gearset	1,250	12	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais G
L-b	Gearset	1,250	12	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais H
L-b	Gearset			Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais Tractor
None	None			Strom	Pressure	Dry-d	Selec	Unit-m	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Martin R
None	None			Strom	Pressure	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin S
Cent	Motor	1,000	13½	Strom	Pressure	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin E
Cent	Motor	1,000	13	Strom	Pressure	Wet-d	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin L
Cent	Motor	1,400	20	Strom	Spl-press	Wet-d	Selec	Unit-m	3	5½-1	Bevel	Tor-t	½-Ell	Plat	Right	Cent	R-r	Menominee A3
Cent	F-wheel	1,200	16	Strom	Spl-press	Dry-d	Selec	Unit-m	3	7 -1	Doub-r	T-arm	½-Ell	Plat	Right	Cent	R-r	Menominee B3
Cent	F-wheel	1,400	14	Strom	Spl-press	Dry-p	Selec	Unit-m	3		Doub-r	T-arm	½-Ell	Plat	Right	Cent	R-r	Menominee C
		1,000	15	Own	Spl-press	Wet-d	Plan	Unit-m	2	8 -1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Mercury P
Cent	Motor	1,200	18	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	R-r	Modern L
Cent	Motor	1,200	16	Scheb	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn	Blank	½-Ell	½-Ell	Left	Cent	R-r	Modern H
Cent	Motor	1,200	16	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	R-r	Modern M
				Strom	Circ-spl	Cone	Selec	Amid	3	7 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moon B
Cent	Motor	1,000	18.11	Scheb	Spl-press	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moore 1½
Cent	Motor	1,000	17.4	Scheb	Spl-press	Cone	Selec	Unit-j	3	6¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moore 2
Cent	Motor	1,000	14	Scheb	Spl-press	Cone	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 3
Cent	Motor	1,000	12	Scheb	Spl-press	Cone	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 4
Cent	Motor	950	10	Scheb	Spl-press	Cone	Selec	Unit-j	4	9½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 5
		1,500	20	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6 -1	Top worm	R-r	½-Ell	½-Ell	Right	Cent	R-r	Moreland 7X
		1,500	18	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	R-r	½-Ell	½-Ell	Right	Cent	R-r	Moreland 1X
Cent	Motor	1,100	15	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	R-r	Moreland 2X
Cent	Motor	950	12	Master	Circ-spl	Dry-d	Selec	Amid	4	10½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	R-r	Moreland 3X
Cent	Motor	950	10	Master	Circ-spl	Dry-d	Selec	Unit-j	4	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moreland 5X
Cent	Motor	900	8	Master	Pressure	Cont-b	Selec	Unit-j	4	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moreland 6X
		1,400	28		Splash	None	Fric	Amid	Any		Sing chn		½-Ell	½-Ell	Left	Cent	R-r	Motokart 1&2
None	None	1,100	15	Zenith	Pressure	Cone	Selec	Unit-j	3	6¾-1	Dbl chn†		½-Ell	½-Ell	Left	Cent	R-r	Natco 20
Cent	Motor	950	17	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM. E1
Cent	Motor	950	15	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM. E1½
Cent	Motor	950	15	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	7¼-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM. E2
Cent	D-shft		15	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Netco C
Hyd	Motor	1,000	18	Strom	Spl-press	Cone	Selec	Unit-j	3	3½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	New York L
				Strom	Circ-spl	Cone	Selec	Unit-m	3	5 -1	Bevel	R-r	½-Ell	Ellip	Left	Cent	R-r	O. K. C&D
Cent	Motor	1,265	16	Holley	Spl-press	Cone	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Left	Springs	Old Hickory 30W
		1,600	16	Carter	Spl-press	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Old Reliable 1½
		1,400	15	Strom	Spl-press	Wet-d	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 2
		1,400	14	Strom	Spl-press	Wet-d	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 3
Cent	D-shft	1,400	14	Strom	Spl-press	Wet-d	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 4
Cent	D-shft	1,400	12	Strom	Spl-press	Wet-d	Selec	Unit-j	3	8¼ 1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 5
Cent	D-shft	1,000	10	Carter	Spl-press	Wet-d	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 7
				Scheb	Circ-spl	Cone	Selec	Unit-x	3	3¾-1	Bevel	Tor-t	½-Ell	¾-Ell	Left	Cent	Tor-t	Overland 81
Cent	Motor	1,000	14	Own	Splash	Dry-p	Prog	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 2
Cent	Motor	1,000	12	Own	Splash	Dry-p	Prog	Unit-j	3	11 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 3
Cent	Motor	1,000	12	Own	Splash	Dry-p	Prog	Unit-j	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 4
Cent	Motor	1,000	8½	Own	Splash	Dry-p	Prog	Unit-j	3	11¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 5
Cent	Motor	1,000	8½	Own	Splash	Dry-p	Prog	Unit-j	3	11¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 6
		1,400	20	Own	Fuel-inj	Dry-d	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Palmer-Moore D
		1,500	25	Zephyr	Circ-spl	Cone	Selec	Unit-m	3		Bevel	Tor-t	½-Ell	½-Ell	Right	Cent	Tor-t	Paulding O

Carburetor Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-in, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reverse cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** mid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels:* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left;* St-col, *steering column* **Propulsion** R-r, *radius rods;* T-arm *torque arm;* Tor-t *torsion tube;* Sub-f, *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

				TIRES			MOTOR											
					SIZES IN INCHES			CYLINDERS						COOLING		IGNITION		
Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	Kind	Front	Rear	Location	No.	Bore in Ins.	Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Water Circulation	Radiator Type	Type	Make	Spark Advance
Paulding H	1,500	950	120	Solid	36x2½	36x3	Under hood	4	3.50	5.00	19.61	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding G	2,000	1,300	120	Solid	36x3	36x3½	Under hood	4	4.00	5.25	25.60	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding M	4,000	1,950	145	Solid	36x4	36x4d	Under hood	4	4.62	5.25	34.28	Block	R&H	Gear	Finned	Dual	Day-D	Hand
Peerless 3	6,000	3,700	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 4	8,000	4,000	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 5	10,000	4,500	151*	Solid	36x6	42x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 6	12,000	5,000	151*	Solid	36x6	42x7d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Pierce-Arrow 2	4,000	3,000	150*	Solid	36x4	36x4d	Under hood	4	4.00	5.50	25.60	Pairs	Opp	Cent	Finned	Sing	Bosch	Hand
Pierce-Arrow 5	10,000	4,500	168*	Solid	36x5	40x6d	Under hood	4	4.87	6.00	38.25	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Reo J	4,000	1,650	130*	Solid	36x4	36x3½d	Under hood	4	4.12	4.50	27.20	Pairs	R&H	Cent	Finned	Dual	Nat'l	Hand
Republic 1500	1,500	......	124	Solid*	35x3*	35x3½*	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Republic 1	2,000	1,350	124	Solid	35x3	35x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Republic 1½	3,000	1,475	144	Solid	35x3½	35x5*	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Reland 1	2,000	2,000	120	Solid	34x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Reland 3	6,000	3,500	144	Solid	36x5	36x5d	Under hood	4	4.25	6.75	29.00	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Reland 3½	7,000	3,500	156	Solid	36x5	40x5d	Under hood	4	4.50	6.75	32.40	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Rowe CW	3,000	2,450	144	Solid	34x3½	36x3d	Under hood	4	4.00	5.00	25.60	Block		Thermo	Sq-t	Dual	Bosch	Hand
Rowe DW	4,000	2,800	150	Solid	36x4	36x4d	Under hood	4	4.25	5.00	29.00	Pairs		Cent	Sq-t	Dual	Bosch	Hand
Rowe EW	6,000	3,400	156	Solid	36x5	40x5d	Under hood	4	4.00	5.50	25.60	Pairs		Cent	Sq-t	Dual	Bosch	Hand
Rowe GW	10,000	4,500	171	Solid	36x6	40x6d	Under hood	4	4.75	5.50	36.15	Pairs		Cent	Sq-t	Dual	Bosch	Hand
Royal B3½	7,000	3,400	132	Solid	36x5	40x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Royal A5	10,000	4,500	138	Solid	36x6	40x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Sandow 1½	3,000	1,900	125*	Solid	36x3	36x4	Under hood	4	3.75	5.25	22.50	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 2	4,000	2,250	125*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 3	6,000	3,000	147*	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	L&H	Gear	Cell	Dual	Bosch	2-pt
Sanford O	1,500	1,290	120	Solid*	36x3*	36x3½*	Under hood	4	3.50	5.12	19.61	Block	Right	Thermo	Finned	Sing	Split	Fixed
Sanford K	3,000	1,660	106	Solid	36x3½	36x3½	Under floor	4	4.00	4.50	25.60	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford L	4,000	1,910	118	Solid	36x3½	36x4	Under floor	4	4.12	5.00	27.20	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford M	4,000	1,910	140	Solid	36x3½	36x5	Under hood	4	4.12	5.00	27.20	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Saxon A2	400	395-c	96	Pneu	28x3	28x3	Under hood	4	2.62	4.00	11.23	Block	Left	Thermo	Cell	Sing	Atw-K	Auto
Selden JB	3,000	2,000	150	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Service W	2,000	2,000	135*	Solid	36x3½	36x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Service Q	3,000	1,975	150	Solid	36x3½	36x5	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service P	4,000	2,375	150	Solid	36x4	40x3½d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service PW	4,000	2,500	160	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service H	6,000	2,975	171	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service HX	10,000	4,000	175*	Solid	36x6	40x6d	Under hood	4	4.75	6.75	36.15	Block	Right	Cent	Cell	Dual	Eisemann	Hand
Signal D	2,000	1,400	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal DL	2,000	1,450	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal F	2,000	1,500	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal FL	2,000	1,550	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Smith A	7,000	3,750	168	Solid	36x5	36x5d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
Smith C	12,000	4,750	168	Solid	36x6	40x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
South Bend 40	4,000	2,000	136*	Pneu*	36x4½*	36x4½*	Under hood	4	4.00	5.00	25.60	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
South Bend 80	8,000	3,000	152	Pneu*	39x6*	39x6*	Under hood	4	5.25	7.00	44.20	Pairs	Opp	Cent	Sq-t	Dual*	Bosch*	Hand
Speedwell 8Y	4,000	2,850	115	Solid	36x4	36x3½d	Under floor	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 10Z	8,000	3,750	115	Solid	36x5	36x5d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 8X	12,000	4,400	139	Solid	36x6	36x6d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Standard-D 3	6,000	2,750	144	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-D 7	14,000	3,300	112	Solid	40x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-O DX	1,500	1,700	......	Pneu	34x4½	34x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Standard-O A	2,000	1,700	134	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O AX	2,000	1,900	124*	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Standard-O B	3,000	1,800	134*	Solid*	37x4½*	36x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O BX	3,000	2,100	134*	Solid*	37x4½*	36x5	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O C	4,000	2,000	144*	Solid*	37x5*	36x5*	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O CX	7,000	3,200	162	Solid	36x5	36x5d	Under hood	4	4.37	6.00	30.65	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Stegeman	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	3,000	2,100	150	C&S	34x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	5,000	2,800	142*	Solid	34x3½	36x3½db	Under hood	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	7,000	3,350	155*	Solid	36x4	40x4db	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	10,000	4,200	168	Solid	36x6	40x6db	Under hood	4	4.50	6.75	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Sternberg	1,000	850-c	88	Pneu	30x4	30x4	Under hood	4	2.75	4.00	12.08	Block	Right	Thermo	Sq-t	Sing	Eisemann	Hand
Sternberg	4,000	2,800	148*	Solid	36x5	36x3½d*	Under hood	4	3.75	5.75	22.50	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	6,000	3,400	158*	Solid	36x6	36x4d*	Under hood	4	4.25	5.75	29.00	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	10,000	4,500	......	Solid	38x6	40x6d	Under hood	4	4.50	5.75	32.40	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	12,000	4,650	144	Solid	38x6	42x6d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Sternberg	14,000	4,750	144	Solid	38x7	42x7d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Stewart-B	1,500	1,500	124	Pneu	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Cell	Sing	Bosch	Fixed
Stewart-K C	2,000	1,100	96	Solid	36x3	36x3	Under seat	2	5.00	5.50	20.00	Sing	Head	Cent	Finned	Dual	King	Hand
Studebaker 5	1,500	985	108	Pneu	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Left	Cent	Finned	Dual		Hand
Sullivan G	3,000	1,600	129	Solid	36x3	36x4	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Tiffin A	1,500	1,600	112	Solid	34x3	34x3	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Hand

ABBREVIATIONS: General, *, *with other options*; Opt, *optional*. **Price**, -c, *complete with body*. **Tires, Kind**, Pneu, *pneumatic*; Sol-st, *solid in front, steel in rear*; P&s, *pneumatic in front, solid in rear*; P&c, *pneumatic in front, cushion in rear*; C&s, *cushion in front, solid in rear*. **Tire Sizes**, d, *dual*. **Motor Location**, Betw seats, *between seats*. **Cylinder Cast**, Sing, *singly or individually*. **Location of Valves**, Opp, *opposite, or T-head type*; Top (2-cylinder motors, only), *L-head cylinder laid horizontal with valves up*; R&h, *at right and in head, L-head cylinder*; L&h, *at left and in head, L-head cylinder*; 2-cyc, *two-cycle motor, no valves*; Back, *L-head motor placed transversely with valves at rear*. **Water Circulation**, Cent, *centrifugal, pump*; Gear, *gear pump*; Thermo, *thermo-syphon circulation*; Air, *air-cooled, no water*. **Radiator Type**, Finned, *finned-tube*; Cell, *cellular or honeycomb*; Sq-t, *square-tube or flat-tube*; Z-z-t, *zig-zag-tube or crimped flat-tube*. **Ignition, Type**, Sing, *single*; Doub, *double*; Dual-d, *dual-double*. **Make of Magneto** (or other sparking devices), Split, *Splitdorf*; Conn, *Connecticut*; King, *Kingston*; West, *Westinghouse*; Day-D, *Dayton-Dick*; Atw-K, *Atwater-Kent*. **Spark Advance**, Auto, *automatic*; 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance*. **Governor Type**, Cent, *centrifugal*; L-b, *loose-ball*; Suct, *suction*; Hyd, *hydraulic*. **Governor Drive**, Motor, *from motor*; D-shft *from driving shaft*; F-wheel, *from front wheel*; Gearset, *from gearset countershaft*; Duplex, *from both the motor and the driving shaft, by overrunning clutches*.

Courtesy of The Commercial Vehicle.

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cities of Motor Trucks Now Built by American Manufacturers

Motor: Governor Type	Motor: Governor Drive	Motor: Speeds Motor in R.p.m.	Motor: Speeds Truck in M.p.h.	Motor: Carbureter Make	Motor: Lubrication	Transmission: Clutch Type	Transmission: Gearset Type	Transmission: Gearset Location	Transmission: Gearset Speeds	Transmission: Total Gear-Ratio in High	Transmission: Final Drive	Transmission: Torque Taken By	Springs: Front	Springs: Rear	Control: Steer	Control: Levers	Propulsion Taken By	Name and Model
				Scheb	Circ-spl	Cone	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Paulding H
		1,800	30	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	Paulding G
				Scheb	Circ-spl	Dry-d	Selec		3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	Paulding M
Cent	Motor	925	14¾	Peerless	Splash	Cone	Selec	Amid	4	7½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 3
Cent	Motor	925	12¾	Peerless	Splash	Cone	Selec	Amid	4	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 4
Cent	Motor	925	10¾	Peerless	Splash	Cone	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 5
Cent	Motor	925	10	Peerless	Splash	Cone	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 6
Cent	Motor	1,050	16	Own	Pressure	Cone	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Pierce-Arrow 2
Cent	Motor	950	14	Own	Pressure	Cone	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Pierce-Arrow 5
Hyd	Motor	1,200	12	Holley	Circ-spl	Dry-d	Selec	Amid	3	8¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Reo J
Suct	Motor	1,050	18	Strom	Spl-press	Dry-d	Selec	Unit-m	3	6¾-1	Int-g	Springs	½-Ell	½-Ell	Left	Cent	Springs	Republic 1500
Suct	Motor	1,000	15	Strom	Spl-press	Cone	Selec	Unit-j	3	7¼-1	Dbl chn		½-Ell	¼-Ell	Left	Cent	R-r	Republic 1
Suct	Motor	1,000	15	Strom	Spl-press	Cone	Selec	Unit-j	3	7¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Republic 1½
None	None	1,500	18	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	¼-Ell	Left	Left	R-r	Roland 1
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Top worm	Springs	Ellip	Ellip	Left	Left	Springs	Roland 3
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	Roland 3½
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe CW
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe DW
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe EW
				Ray	Pressure	Wet-d			3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe GW
L-b	Motor	900	15	Strom	Pressure	Wet-d	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Royal B3½
L-b	Motor	900	12	Strom	Pressure	Wet-d	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Royal A5
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 1½
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 2
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 3
		1,100	18	Muir	Circ-spl	Dry-d	Selec	Unit-m	3	7 -1	Int-g	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sanford O
Cent		1,100	16	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sanford K
Cent	Motor	1,100	14	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sanford L
Cent	Motor	1,100	14	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Sanford M
		1,600	40	Mayer	Splash	Dry-p	Prog	Unit-x	2	4⅜-1	Bevel	Tor-t	¼-Ell	¼-Ell	Left	Cent	Tor-t	Saxon A2
Cent*	Motor	1,150	16	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Selden JB
Cent*	Motor	1,000	16	Strom	Spl-press	Cone	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Service W
Cent*	Motor	1,000	14	Strom	Spl-press	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service Q
Cent*	Motor	1,000	12	Strom	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service P
Cent*	Motor	1,000	14	Strom	Pressure	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Service PW
Cent*	Motor	1,000	11	Strom	Spl-press	Cone	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service H
Cent	Motor	870	12	Strom	Spl-press	Cone	Selec	Unit-j	4	6⅞-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Service HX
Suct	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Signal D
Suct	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Signal DL
Suct	Motor	1,200	15	Strom	Circ-spl	Dry d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½ Ell	½-Ell	Left	Cent	Springs	Signal F
Suct	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Signal FL
Suct	Motor	900	12	Strom	Circ-spl	Dry-d	Ind-c	Unit-s	3	8⅓-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	Smith A
Suct	Motor	1,000	9	Strom	Circ-spl	Dry-d	Ind-c	Unit-s	3	8⅓-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	Smith C
Suct	F-wheel	1,800	25	Strom	Spl-press	Wet-d	Selec	Unit-j	3	4 -1	Dbl chn		½-Ell	½-Ell	Opt	Opt	R-r	South Bend 40
Suct	F-wheel	1,400	30	Strom	Spl-press	Wet-d	Selec	Unit-j	3*	4 -1	Dbl chn		½-Ell	½-Ell	Right	R&C	R-r	South Bend 80
Cent	Motor	1,100	15	Scheb	Circ-spl	Cone	Selec	Amid	3	9⅓-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 8Y
Cent	Motor	1,200	12	Scheb	Circ-spl	Cone	Selec	Amid	3	10¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 10Z
Cent	Motor	1,200	10	Scheb	Circ-spl	Cone	Selec	Amid	3	10¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 8X
Suct	Motor	1,200	12	Strom	Circ-spl	Dry-d	Prog	Unit-m	3	9 -1	T-worm*	T-arm*	½-Ell	½-Ell	Left	Cent	Springs*	Standard-D 3
Suct	Motor	1,200	10	Strom	Circ-spl	Dry-d	Prog	Unit-m	3		Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Standard-D 7
L-b	Motor			Strom	Circ-spl	Dry-d	Selec	Amid	3	5⅛-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O DX
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O A
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O AX
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O B
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O BX
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O C
L-b	Motor	1,000	14	Scheb	Circ-spl	Dry-d	Selec	Amid	3	8⅔-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O CX
Cent	Motor	1,100	20	Carter	Spl-press	Dry-d	Selec	Unit-m	3	6 -1	Bevel	R-r	½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	18	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	15	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	12	Carter	Spl-press	Dry-d	Selec	Unit-m	3	11⅔-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	10	Carter	Spl-press	Dry-d	Selec	Unit-m	3	14⅓-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
None	None	1,500	19		Spl-press	Cone	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,020	14	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,020	13	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,000	11	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	950	10	Holley	Circ-spl	Wet-d	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sternberg
Cent	Motor	950	10	Holley	Circ-spl	Wet-d	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sternberg
Cent	Motor		30	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	5¼-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Stewart-B
		600	18	Scheb	Spl-press	Wet-d	Plan	Unit-m	2		Dbl chn		½-Ell	½-Ell	Left		R-r	Stewart-K C
			20	Scheb	Circ-spl	Cone	Selec	Unit-x	3	4⅜-1	Bevel	T-arm	½-Ell	Ellip	Left*	Cent*	R-r	Studebaker 5
Cent	Motor	1,350	18	Holley	Circ-spl	Cone	Selec	Unit-j	3	7¼-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Sullivan G
None	None			Breeze	Circ-spl	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin A

Carbureter Make. Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic; on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left;* St-col, *steering column.* **Propulsion,** R-r, *radius rods;* T-arm, *torque arm;* Tor-t *torsion tube;* Sub-f, *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES: Kind	TIRES: Sizes in Inches: Front	TIRES: Sizes in Inches: Rear	MOTOR: Location	CYLINDERS: No.	CYLINDERS: Bore in Ins.	CYLINDERS: Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING: Water Circulation	COOLING: Radiator Type	IGNITION: Type	IGNITION: Make	IGNITION: Spark Advance
Tiffin G	2,000	2,000	128	Solid	36x3½	36x4	Under hood	4	3.75	4.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Hand
Tiffin M	4,000	2,700	140	Solid	36x4	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Hand
Trabold T	2,000	1,250	118	Solid	36x3	38x3½	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Cell	Dual	Briggs	Hand
Trabold	4,000	2,450	130	Solid	36x4	38x3d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Dual	West	Hand
Trabold	6,000	3,300	130	Solid	36x4	38x4d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell	Dual	West	Hand
Trumbull 15D	500	395-c	80	Pneu	28x3	28x3	Under hood	4	2.87	4.00	13.37	Block	Right	Thermo	Finned	Sing	Split	Fixed
Universal C	3,000	1,950	132	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Thermo	Finned	Sing	Eisemann	Hand
Universal A	6,000	3,400	132	Solid	36x5	36x4d	Under floor	4	4.00	5.50	25.60	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
U. S. E	4,000	2,550	132	Solid	34x3½	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. G	5,000	2,750	138	Solid	34x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. D	6,000	3,200	144	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. F	8,000	3,550	156	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Velie X	2,000	2,000	129*	Solid*	36x3½*	36x4	Under hood	4	4.62	5.25	34.28	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Velie U	3,000	2,250	140	Solid	36x4	36x5*	Under hood	4	4.62	5.25	34.28	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie	5,000	2,850	148*	Solid	36x4	36x4d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie Z	8,000	3,350	148*	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Velie Z5	10,000	3,750	148*	Solid	36x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Vim L&F	1,000	620	94	Pneu	30x3½	30x3½	Under hood	4	3.00	4.50	14.40	Block	Right	Thermo	Finned	Sing	Atw-K	Hand
Vulcan 2	5,000	2,750	150*	Solid	36x4	30x3½d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 3	7,500	3,250	156*	Solid	36x5	34x4d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 4	9,200	4,000	162	Solid	35x5	35x5d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 5	11,500	4,500	162	Solid	36x6	36x6d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 7	15,500	6,000	156*	Solid	36x7	42x7d	Under hood	4	4.75	5.50	36.15	Pairs	Left	Gear	Cell	Dual-d	Bosch	Hand
Wagenhals	800	690-c	80	P&C	30x3	34x4½	Under hood	4	3.50	3.37	19.61	Pairs	Back	Gear	Finned	Dual		Hand
Walter 5	10,000	4,500	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 6	12,000	4,750	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 7½	15,000	5,000	144	Solid	40x6	40x6d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter Tractor	24,000	4,500	108	Solid	40x4d	40x4d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Ware	6,000			Solid			Under hood	4	4.00	5.50	25.60	Pairs		Gear			Mea	
White GBBE	1,500	2,100	133½	Pneu	34x4½	34x4½	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell	Sing	Bosch	Hand
White TBC	3,000	3,000	145½	Pneu	36x4½	36x4½d	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell	Sing	Bosch	Hand
White TAD	6,000	3,700	163	Solid	36x5	40x5d	Under hood	4	3.75	5.12	22.50	Block	Left	Cent	Cell	Sing	Bosch	Hand
White TCD	10,000	4,500	165	Solid	36x5	40x6d	Under hood	4	4.25	6.37	29.00	Block	Left	Cent	Cell	Sing	Bosch	Hand
Wichita A	2,000	1,650	110	Solid	34x3	34x4	Under hood	4	3.25	5.00	16.92	Block	L&H	Thermo	Cell	Sing	Bosch*	Hand
Wichita B	4,000	2,100	118	Solid	34x3½	34x3d	Under hood	4	3.50	5.00	19.61	Block	L&H	Thermo	Cell	Sing	Bosch*	Hand
Wichita H	7,000	3,250	165	Solid	36x5	36x5d	Under hood	4	4.25*	6.75	29.00*	Pairs	L&H	Cent	Cell	Dual	Bosch	Hand
Wilcox T	1,000	1,000	115	Pneu	33x4	33x4	Under hood	4	3.50	5.00	19.61	Block		Thermo	Z-z-t	Sing	Mea	Hand
Wilcox LA	2,000	2,000	132	Solid*	36x3½*	36x5d*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Z-z-t	Sing	Mea	Hand
Wilcox NA	4,000	2,500	118	Solid	36x4	36x3½d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-z-t	Dual	Bosch	Hand
Wilcox JA	6,000	3,250	128	Solid	36x5	36x4d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-z-t	Dual	Bosch	Hand
Willet M	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet L	4,000	2,600	144	Solid	36x4	36x4db	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet K	6,000	2,800	144*	Solid	36x4	36x4db	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Finned	Sing	Eisemann	Auto
Wilson B	4,000	1,800	130*	Solid	37x3½	37x5	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Willys 65	1,500	1,350	120	P&S	34x4½	36x3½	Under hood	4	4.12	4.50	27.20	Sing	Left	Thermo	Finned	Dual	Split	Hand

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Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES: Kind	TIRES: Sizes in Inches: Front	TIRES: Sizes in Inches: Rear	MOTOR: Location	CYLINDERS: No.	CYLINDERS: Bore in Ins.	CYLINDERS: Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING: Water Circulation	COOLING: Radiator Type	IGNITION: Type	IGNITION: Make	IGNITION: Spark Advance
Handy Wagon, Jr.	500	390	65	Solid	34x1½	34x1½	Under body	2	3.75	3.75	11.25	Sing	R&H	Air		Sing	None	Hand
Handy Wagon	800	487.50	77	Solid	34x1¾	34x1¾	Under body	2	4.12	3.75	13.60	Sing	R&H	Air		Sing	None	Hand
Handy Wagon, Sr.	1,200	600	86	Solid	34x1¾	34x2	Under body	2	4.75	4.75	18.10	Sing	R&H	Air		Sing	Briggs	Hand
Hurlburt 1	2,000	1,500	120	Pneu	34x4½	34x4½	Under hood	4	3.75	4.50	22.50	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 2	4,000	3,000	Opt	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 3½	7,000	3,500	Opt	Solid	36x5	36x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Locomobile 3	6,000	3,500	150*	Solid	36x5	36x5d	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
Locomobile 4	8,000	3,600	150*	Solid	36x5	36x6d	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
C. T. Tractor	10,000	4,750	155	Solid	36x4d	36x5d	Under seats	4	4.00	6.00	25.60	Sing	R&h	Cent	Sq-t	Sing	Mea	2-pt
Transit E	2,000	2,000	120*	Solid	36x4	36x3½d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit F	4,000	2,850	144	Solid	36x4	36x4d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit T	7,000	3,500	144	Solid	36x5	36x5d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit V	10,000	4,500	144*	Solid	36x6	40x6d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Dispatch L	1,200	900	120	Pneu	36x3½	36x3½	Under hood	4	3.75	5.00	22.50	Block	Left	Thermo	Cell	Dual	Bosch	Hand
Morton 1½	3,000			Solid	34x4	38x5	Under seat	4	3.75	5.25	22.50	Pairs	Opp		Cell	Dual	Bosch	Hand
Morton 2	4,000		140	Solid	36x5	38x6		4	4.50	5.50	30.65	Pairs		Cent		Dual	Bosch	Hand
Morton 2½	5,000		140	Solid	36x5	38x6	Under seat	4	4.50	5.50	30.65	Pairs		Cent	Cell	Dual	Bosch	Hand
Morton 3	6,000		112	Solid					4.75	6.75								
Morton 3½	7,000			Solid	38x6	40x6d		4	5.00	5.75	40.00	Pairs	Opp		Cell		Bosch	Hand
Morton 5	10,000			Solid	38x7	42x7d		4	5.25	5.75	42.20	Pairs	Opp		Cell	Dual	Bosch	Hand
Morton 6	12,000		140	Solid					5.50	7.00								
Morton Tractor	20,000		108	Solid	40x6	40x6db		4	5.50	7.00	48.48	Sing			Cell	Dual	Split	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

Courtesy of The Commercial Vehicle.

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin G
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8⅞-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin M
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold T
None	None			Strom	Circ-spl	Dry-p	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None		50	B-Z	Circ-spl	Cone	Selec	Unit-x	3	3⅔-1	Bevel	Tor-t	I-½ Ell	Cant	Left	Cent	Tor-t	Trumbull 15D
Cent	Motor	1,050	15	Breeze	Circ-spl	Dry-p	Selec	Unit-m	3	7¼-1	Top worm	R-r	½-Ell	½-Ell	Left	Cent	R-r	Universal C
Cent	Motor	1,000	11½	Breeze	Circ-spl	Dry-d	Selec	Unit-j	3	10¼-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Universal A
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. E
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. G
Cent	Motor	1,092	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. D
Cent	Motor	1,092	12	Strom	Circ-spl	Cone	Ind-c	Amid	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. F
Suct	Motor	900	18	Strom	Circ-spl	Dry-p	Selec	Amid	3	7¾-1	Doub-r	T-arm	½-Ell	½-Ell	Left	Cent	T-arm	Velie X
Suct	Motor	1,000	17	Strom	Circ-spl	Dry-p	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Velie U
Cent	Motor	1,000	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	8⅓-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-p	Selec	Amid	3	10 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie Z
Cent	Motor	1,000	8	Strom	Circ-spl	Dry-p	Selec	Amid	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie ZS
			25	Carter	Splash	Cone	Selec	Unit-m	3	4¼-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	Vim L&F
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 2
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 3
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9⅛-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 4
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9⅛-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 5
Cent	Motor	1,250	13½	Strom	Circ-spl	Cone	Prog	Unit-j	4	11½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 7
None	None	1,800	30	Marvel	Circ-spl	Wet-d	Plan	Unit-m	2	6 -1	Sing chn		½-Ell	½-Ell	Cent	None	R-r	Wagenhals
Cent	Motor	1,000	14	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 5
Cent	Motor	1,000	12	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 6
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 7½
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter Tractor
Cent	Motor	1,100				Wet-d			4		Bevel-4			Plat		Right		Ware
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Bevel	Springs	½-Ell	½-Ell	Left	C&l	R-r	White GBBE
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Doub-r	Springs	½-Ell	½-Ell	Left	C&l	R-r	White TBC
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TAD
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TCD
		1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita A
None	None	1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita B
Cent	Motor	1,500	11	Strom	Circ-spl	Cone	Selec	Unit-j	3	9⅝-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wichita H
Cent	Motor	1,100			Circ-spl	Dry-d	Selec	Unit-m			Bevel	Tor-t	½-Ell	¾-Ell	Left	Cent	Tor-t	Wilcox T
Cent	Motor	1,100	16		Circ-spl	Cone	Selec	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wilcox LA
Cent	Motor	1,100	14		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox NA
Cent	Motor	1,100	13		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox JA
		1,004	20	Zenith	Spl-press	Cone	Selec	Amid	3	5⅞-1	Doub-r	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Willet M
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet L
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet K
Cent	Motor	1,000	15	Marvel	Pressure	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wilson B
Cent	Motor	1,150	18	Scheb	Circ-spl	Cone	Selec	Unit-j	3	6⅝-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Willys 65

Received Too Late to Classify

Type	Drive	Motor in R.p.m.	Truck in M.p.h.	Carbureter Make	Lubrication	Clutch Type	Gearset Type	Location	Speeds	Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
				King	Splash	Dry-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Jr.
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Sr.
Cent	Motor	1,250	18	Flech	Spl-press	Dry-d	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Hurlburt 1
Cent	Motor	1,250	15	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 2
Cent	Motor	1,250	13	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 3½
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 3
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 4
Cent	Motor	1,350	13	Strom	Circ-spl	None	Elec	Unit-m	2	20¼-1	Doub-r	Springs	½-Ell	½-Ell	Left		R-r	C. T. Tractor
Cent	Motor	1,200	15	Ray	Splash	Wet-d	Selec	Unit-j	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit E
Cent	Motor	1,200	14	Ray	Splash	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit F
Cent	Motor	1,200	12	Ray	Splash	Wet-d	Selec	Unit-j	3	10 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit T
Cent	Motor	1,200	10½	Ray	Splash	Wet-d	Selec	Unit-j	3	13 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit V
Suct	Motor	1,500	25	Ray	Press	None	Fric	Amid	5		Dbl chn		Ellip	Ellip	Right	Cent	R-r	Dispatch L
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 1½
L-b	Motor			Carter	Spl-press	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 2
L-b	Motor			Strom*	Spl-press	Wet-d	Selec		3		Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Springs	Morton 2½
							Selec		4		Top worm4							Morton 3
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 3½
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 5
							Selec		4		Top worm4							Morton 6
			14		Spl-press	Wet-d	Selec		3		Top worm							Morton Tractor

Carbureter Make, Strom. *Stromberg* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *Electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left;* St-col, *steering column.* **Propulsion,** R-r, *radius rods;* T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f *sub-frame.*

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES Kind	TIRES Sizes in Inches Front	TIRES Sizes in Inches Rear	MOTOR Location	Cylinders No.	Cylinders Bore in Ins.	Cylinders Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Cooling Water Circulation	Cooling Radiator Type	Ignition Type	Ignition Make	Ignition Spark Advance
Gabriel K	1,000	1,200	112	Pneu	32x4	32x4	Under hood	4	3.50	5.00	19.61	Block	R&H	Cent	Z-z-t	Sing	Bosch	Fixed
Gabriel H	1,500	1,600	126	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Gabriel M	3,000	2,300	144	Pneu	36x5	36x5d	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Garford L	4,000	3,000	128*	Solid	36x5	40x3½d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford J	6,000	3,500	128*	Solid	36x5	40x4d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford K	8,000	3,850	128*	Solid	36x5	40x5d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford D	10,000	4,500	128*	Solid	36x6	40x6d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford F	12,000	4,850	128*	Solid	36x6	40x7d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
GASchacht 2	4,000	2,800	138	Solid	38x3½	40x3½d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell	Sing	Eisemann	Hand
GASchacht 3	6,000	3,200	150	Solid	38x4	40x4d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell	Sing	Eisemann	Hand
Geneva B	1,500	700	96	Solid	34x2	36x2½	Under hood	2	5.12	4.50	21.10	Sing		Gear	Finned	Sing	Opt	Fixed
GMC 15	1,500	1,090	122	Pneu	35x5	35x5	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Finned	Sing	Eisemann	Hand
GMC VC	2,500	1,500	126	Solid	34x3	36x5	Under hood	4	3.50	5.25	19.61	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC SC	4,000	1,900	143	Solid	34x4	36x3½d	Under hood	4	4.00	6.00	25.60	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC HU	7,000	2,500	158	Solid	36x5	42x5d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
GMC KU	10,000	3,000	158	Solid	36x6	42x6d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
Gramm 1½	3,000	2,600	129	Solid	34x3½	38x5	Betw. seats	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 2	4,000	3,600	128	Solid	36x4	36x3½d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 3½	7,000	4,600	140	Solid	36x5	36x5d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm 5	10,000	5,350	140	Solid	36x5	40x6d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Harvey F	3,000	1,800	130	Solid	34x3½	38x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Eisemann	Auto
Harvey H	6,000	3,000	168	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Left	Cent	Z-z-t	Sing	Eisemann	Auto
Herner 1	2,000	2,000	145	Solid	34x3½	34x4	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 1½	3,000	2,250	145	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 2	4,000	2,650	145	Solid	36x4	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Herner 3	6,000	3,200	145	Solid	36x5	40x4d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Gear	Finned	Dual	Bosch	Hand
Herner 5	10,000	4,200	156	Solid	38x6	42x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Gear	Finned	Dual	Bosch	Hand
Hupmobile HT	800	850	106	Pneu	33x4	33x4	Under hood	4	3.25	5.50	16.92	Block	Left	Thermo	Cell	Sing	Bosch	Hand
I. H. C. M	1,000	......	90	Solid	42x2	42x2	Under seat	2	4.50	5.00	16.20	Sing	Head	Cent	Finned	Dual	Heinze	Hand
Independent F	1,500	1,285	112*	Solid	36x3	36x3	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Z-z-t	Sing	Mea	Hand
Independent E	3,000	1,850	122*	Solid	36x3½	36x5	Under hood	4	3.75*	5.25	22.50	Block	Left	Cent	Z-z-t	Sing	Mea	Hand
Indiana B	3,000	1,800	135	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Dual	Bosch	Hand
Indiana F	6,000	2,500	144	Solid	36x4	36x3½d	Under hood	4	4.25	5.25	29.00	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Indiana K	10,000	3,200	165	Solid	36x5	40x4d	Under hood	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Jeffery 1515	1,500	1,300	118	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery 3015	3,000	1,650	130	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery 4015	4,000	2,750	124	Solid	36x5	36x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Z-z-t	Dual	Bosch	Hand
Kalamazoo B	3,000	1,590	126	Solid	37x3½	37x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Bosch	Hand
Kelly K-30	2,000	2,000	120*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Sing	Eisemann	Auto
Kelly K-35	4,000	2,750	144*	Solid	36x4	36x4d	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Sing	Eisemann	Auto
Kelly K-40	7,000	3,400	150*	Solid	38x5	38x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Kelly K-50	10,000	4,250	150*	Solid	38x6	40x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
King 3½	7,000	3,200	120	Solid	36x5	36x5d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch	2-pt
Kisselkar 1500	1,500	1,500	125	Pneu	35x4½	35x4½	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 1	2,000	1,850	140	Pneu	37x5	37x5	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 1½	3,000	2,100	132*	Solid	34x3½	38x5	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 2½	5,000	2,750	144*	Solid	36x4	38x4d	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 3½	7,000	3,350	162	Solid	36x5	40x5d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar 6	12,000	4,350	168	Solid	36x6	40x6d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kleiber 1	3,000	2,000	140*	Solid	36x3½	36x5d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 2	5,000	2,750	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 3	7,000	3,300	160*	Solid	36x4½	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber 5	10,000	4,000	170	Solid	36x5	40x6d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Z-z-t	Dual	Bosch*	Hand*
Knox Tractor 31	12,000	3,250	139	Solid	34x5	36x5d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell	Dual-d	Bosch	Hand
Knox Tractor 32	20,000	3,750	140	Solid	34x5	38x6d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell	Dual-d	Bosch	Hand
Koehler 1	2,000	725	90	Solid	36x2½	36x2½	Under body	2	5.25	4.00	22.10	Sing	Top	Thermo	Finned	Sing		Fixed
Kosmath 14	1,000	850	110	Pneu	32x3½	34x4	Under hood	4	3.50	4.00	19.61	Pairs	Right	Cent	Finned	Sing	Eisemann	Fixed
Krebs G	2,000	1,900	118	Solid	34x3½	34x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Auto
Krebs H	4,000	2,350	144*	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Auto
LaFrance 6	10,000	5,500	140	Solid	36x5	38x6d	Under hood	4	5.50	6.00	48.48	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Lambert V1	800	900	106	Pneu	30x3½	31x4	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell	Sing	Bosch	Fixed
Lambert V2	1,500	1,125	114	Pneu.*	33x4*	33x4½*	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell	Sing	Bosch	Fixed
Lambert V3	2,000		120	Solid	36x3	36x3½	Under hood	4	4.06	4.50	26.27	Block	Left	Cent	Cell	Dual	Briggs	Hand
Lambert V4	3,000	1,900	120	Solid	36x4½	36x4	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell	Dual	Briggs	Hand
Lambert V5	4,000	2,200	120	Solid	36x4	36x5	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell	Dual	Briggs	Hand
Lange C	3,000	2,250	125	Solid	36x3½	38x4	Under hood	4	3.75	5.25	22.50	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lange B	5,000	3,000	136	Solid	36x4	38x6	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lewis 21	5,000	2,900	144	Solid	34x3½	36x3½d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis 31	6,000	3,250	144	Solid	34x4	36x5d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis 51	10,000	4,400	144*	Solid	36x6	38x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind**, Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear.* C&s, *cushion in front, solid in rear.* **Tire Sizes**, d, *dual.* **Motor Location**, Betw seats, *between seats.* **Cylinder Cast**, Sing, *singly or individually.* **Location of Valves**, Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation**, Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type**, Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type**, Sing, *single;* Double, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance**, Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type**, Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd. *hydraulic.* **Governor Drive**, Motor, *from motor;* D-shft *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h				Type	Location	Speeds									
......	......	......	30	Opt	Spl-press	Cone	Selec	Unit-m	3	4 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel ... K**
......	......	......	35	Strom	Spl-press	Cone	Selec	Amid	3	4½-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel ... H**
......	......	......	20	Strom	Spl-press	Cone	Selec	Amid	4	8 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel ... M**
Cent	Motor	1,140	14½	Own	Spl-press	Cone	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford ... L**
Cent	Motor	1,140	12¾	Own	Spl-press	Cone	Selec	Unit-j	3	10¾	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford ... J**
Cent	Motor	1,140	10¾	Own	Spl-press	Cone	Selec	Unit-j	3	12½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford ... K**
Cent	Motor	1,140	10½	Own	Spl-press	Cone	Selec	Unit-j	4	13½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford ... D**
Cent	Motor	1,140	8¾	Own	Spl-press	Cone	Selec	Unit-j	4	15½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford ... F**
Cent	Motor	1,000	15	Scheb	Spl-press	Cone	Selec	Amid	3	7½-1	Top-worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht ... 2**
Cent	Motor	1,000	12	Scheb	Spl-press	Cone	Selec	Amid	3	9¾-1	Top worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht ... 3**
......	......	......	18	Scheb	Spl-press	Wet-d	Plan	Unit-j	2	8 -1	Dbl chn		½-Ell	Ellip	Right	Right	R-r	**Geneva ... B**
Suct	Motor	1,150	20	Marvel	Spl-press	Cone	Selec	Amid	3	6 -1	Bevel	R-r	½-Ell	Ellip	Left	Cent	R-r	**GMC ... 15**
Cent	Motor	1,130	14	King	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC ... VC**
Cent	Motor	900	12	King	Spl-press	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC ... SC**
Cent	Motor	800	11	Marvel	Spl-press	Wet-d	Prog	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC ... HU**
Cent	Motor	800	8½	Marvel	Spl-press	Wet-d	Prog	Unit-j	3	12 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC ... KU**
Cent	Motor	......	......	Opt	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Gramm ... 1½**
Cent	Motor	......	......	Opt	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm ... 2**
Cent	Motor	......	......	Opt	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm ... 3½**
Cent	Motor	......	......	Opt	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm ... 5**
L-b	Motor	1,000	16	Holley	Circ-spl	Cone	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Harvey ... F**
L-b	Motor	900	10	Holley	Circ-spl	Cone	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Harvey ... H**
Cent	Motor	1,200	19	Strom	Circ-spl	Dry-d	Selec	Amid	3	6½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner ... 1**
Cent	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	7 -1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner ... 1½**
Cent	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	9½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner ... 2**
Cent	Motor	1,140	12	Strom	Circ-spl	Dry-d	Selec	Amid	3	9¾-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner ... 3**
Cent	Motor	1,000	10	Strom	Circ-spl	Dry-d	Selec	Amid	3	13¾-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner ... 5**
Cent	Motor	1,500	20	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	4 -1	Bevel	Tor-t	½-Ell	Plat	Right	Cent	Tor-t	**Hupmobile ... HT**
......	......	......	......	Scheb	Spl-press	Cont-b	Ind-c	Unit-m	2	9½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	**I. H. C. ... M**
Cent	Motor	1,350	18	Zephyr	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Independent ... F**
Cent	Motor	1,200	15	Zephyr	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Independent ... E**
L-b	D-shft	1,200	17½	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana ... B**
L-b	D-shft	1,200	15½	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana ... F**
L-b	D-shft	1,200	14¾	Scheb	Circ-spl	Dry-d	Selec	Unit-j	3	9¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana ... K**
Suct	Motor	1,100	22	Strom	Spl-press	Dry-p	Selec	Amid	3	4 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	**Jeffery ... 1515**
Suct	Motor	1,100	15	Strom	Spl-press	Dry-p	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Jeffery ... 3015**
Suct	Motor	1,100	14½	Strom	Spl-press	Dry-p	Selec	Amid	4	7¾-1	Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Jeffery ... 4015**
Cent	D-shft	1,600	15	Scheb	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kalamazoo ... B**
L-b	Motor	1,200	15	Breeze	Pressure	Cone	Selec	Amid	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly ... K-30**
L-b	Motor	1,200	11½	Breeze	Pressure	Cone	Selec	Amid	3	11½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly ... K-35**
L-b	Motor	900	9¾	Ray	Pressure	Cone	Selec	Amid	3	11 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly ... K-40**
L-b	Motor	900	8¾	Ray	Pressure	Cone	Selec	Amid	3	12½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly ... K-50**
Cent	Motor	950	12	Scheb	Circ-spl	Dry-d	Ind-c	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**King ... 3½**
Cent	Motor	1,200	25	Strom	Circ-spl	Cone	Selec	Amid	3	5 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar ... 1500**
Cent	Motor	1,200	25	Strom	Circ-spl	Cone	Selec	Amid	4	4½-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar ... 1**
Cent	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	4	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar ... 1½**
Cent	Motor	1,200	12	Strom	Circ-spl	Cone	Selec	Unit-j	4	10 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar ... 2½**
Cent	Motor	1,200	11	Strom	Circ-spl	Cone	Selec	Unit-j	4	11 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar ... 3½**
Cent	Motor	1,200	10	Strom	Circ-spl	Cone	Selec	Unit-j	4	12¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar ... 6**
Cent	Motor	1,200	18	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	7 -1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber ... 1**
Cent	Motor	1,200	16	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber ... 2**
Cent	Motor	1,100	14	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9 -1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber ... 3**
Cent	Motor	1,000	12	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9½-1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber ... 5**
Cent	Motor	1,100	12	Strom	Pressure	Dry-p	Selec	Amid	3	11 -1	Dbl chn		½-Ell	Cant	Right	Cent	R-r	**Knox Tractor ... 31**
Cent	Motor	1,100	10½	Strom	Pressure	Dry-p	Selec	Unit-j	3	12½-1	Dbl chn		½-Ell	Cant	Right	Cent	R-r	**Knox Tractor ... 32**
......	......	......	20	King	Splash	Cone	Plan	Unit-j	2	8 -1*	Dbl chn		½-Ell	Ellip	Left	Cent	R-r	**Koehler ... 1**
......	......	1,100	25	Holley	Splash	Cone	Selec	Unit-m	3	4 -1	Bevel	R-r	½-Ell	Ellip	Left	......	R-r	**Kosmath ... 14**
Cent	Motor	1,025	15	Scheb	Circ-spl	Cone	Selec	Amid	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs ... G**
Cent	Motor	1,100	15	Scheb	Circ-spl	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs ... H**
Cent	Motor	1,200	12	Scheb	Spl-press	None	Hyd	Unit-j	Any	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**LaFrance ... 6**
......	......	......	......	Excel	Spl-press	None	Fric	Amid	Any	3½-1	Sing chn		½-Ell	Ellip	Right	Right	R-r	**Lambert ... V1**
......	......	......	......	Excel	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert ... V2**
......	......	......	......	Scheb	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert ... V3**
Suct	Motor	800	10	Scheb	Spl-press	None	Fric	Amid	Any	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert ... V4**
Suct	Motor	800	9	Scheb	Spl-press	None	Fric	Amid	Any	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert ... V5**
Cent	Motor	1,250	18	Strom	Circ-spl	Wet-d	Ind-c	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Lange ... C**
Cent	Motor	1,250	15	Strom	Circ-spl	Wet-d	Ind-c	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Lange ... B**
Cent	Motor	1,200	14	Ray	Spl-press	Wet-d	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis ... 21**
Cent	Motor	1,200	12	Ray	Spl-press	Wet-d	Ind-c	Amid	3	8¾-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis ... 31**
Cent	Motor	1,000	10	Ray	Spl-press	Wet-d	Ind-c	Amid	3	10½-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis ... 51**

Carbureter Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr*. **Lubrication**, Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash*. **Clutch Type**, Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-e, *expanding shoe;* Cont-b, *contracting band*. **Gearset Type**, Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric*. **Gearset Location**, Amid *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft*. **Final Drive**, Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels*. **Driving Torque**, R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame*. **Springs**, Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames*. **Steering**, Cent, *center*. **Levers**, Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift enter, brake left*, St-col, *steering column*. **Propulsion**, R-r, *radius rods;* T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f *sub-frame*.

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
Lippard-Stew. B*	1,500	1,650	115*	Pneu.	35x4½	35x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. BW*	1,500	1,775	115*	Pneu.	35x4½	35x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. H	2,000	2,000	145	Solid	36x3	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. F	3,000	2,300	145*	Solid	36x3½	36x3d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Lippard-Stew. G	4,000	2,600	158*	Solid	36x4	36x4d	Under hood	4	4.15	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Little Giant H	2,000	1,350	110	Solid	37x3	37x3½	Under floor	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Dual	King	Hand
Locomobile A2	10,000	4,500	140*	Solid	40x6	40x6d	Under floor	4	5.00	6.00	40.00	Pairs	Opp	Cent	Cell	Dual	Bosch	Hand
Locomobile AA2	12,000	4,800	140*	Solid	40x7	40x7d	Under floor	4	5.00	6.00	40.00	Pairs	Opp	Cent	Cell	Dual	Bosch	Hand
M&E B	7,000	3,500	132	Solid	36x6	36x5d	Under hood	4	4.50	5.50	32.40	Block	Right	Cent	Sq-t	Double	Bosch	Hand
M&E G	10,000	2,750	116	Sol-st	36x5d	40x6	Under hood	4	4.25	5.25	29.00	Pairs	Right	Cent	Sq-t	Double	Bosch	Hand
Maccar B	2,000	1,900	138*	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar E	2,000	1,900	138*	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar C	3,000	2,150	150*	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar F	4,000	2,400	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
Maccar D	4,000	2,400	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Eisemann	Hand
McIntyre E	1,500	......	120	Solid	34x3	34x3½	Under hood	4	3.75	5.00	22.50	Block	Right	Thermo	Cell	Sing	Bosch	Hand
McIntyre A	3,000	......	144	Solid	34x3½	36x3d	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Cell	Sing	Bosch	Hand
McIntyre G	6,000	......	144	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Cell	Sing	Bosch	Hand
Mais C	3,000	2,750	119	Solid	37x4	37x5	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais D	3,000	2,800	132	Solid	37x4	37x5	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais E	4,000	2,950	132	Solid	37x4	37x4d	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais F	4,000	3,000	145	Solid	37x4	37x4d	Under hood	4	4.00	5.25	25.60	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais G	5,000	3,200	145	Solid	37x5	37x4d	Under hood	4	4.31	5.25	29.69	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais H	6,000	3,400	160	Solid	37x5	37x5d*	Under hood	4	4.31	5.25	29.69	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Mais Tractor	16,000	2,750	84	Solid	37x4	37x7	Under hood	4	4.31	5.25	29.69	Block	Opp	Cent	Cell	Sing	Eisemann	Auto
Martin R	2,000	2,050	125	Solid	36x3½	36x4	Under hood	4	4.00	5.00	25.60	Block	Left	Cent	Finned	Dual	Remy	Hand
Martin S	3,000	2,150	121	Solid	36x3½	40x4	Under floor	4	4.00	5.00	25.60	Block	Left	Cent	Finned	Dual	Remy	Hand
Martin E	5,000	3,000	135	Solid	36x4	40x3½d	Under floor	4	4.25	5.00	27.20	Pairs	Opp	Cent	Finned	Dual	Remy	Hand
Martin L	7,000	3,500	145	Solid	36x5	40x4d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Finned	Dual	Remy	Hand
Menominee A3	1,500	1,125	112	Solid	33x3½	33x3½	Under hood	4	3.75	4.50	22.50	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Menominee B3	2,000	1,400	122	Solid	34x3½	34x4	Under hood	4	4.00	5.00	25.60	Pairs	Left	Thermo	Finned	Dual	Bosch	Hand
Menominee C	3,000	1,800	130	Solid	36x4	36x5	Under hood	4	4.00	5.00	25.60	Pairs	Left	Thermo	Finned	Dual	Bosch	Hand
Mercury P	1,000	.....	84	Solid	38x2	40x2	Under floor	2	4.25	4.00	14.50	Sing	Opp	Air	....	Dual	Remy	Fixed
Modern L	2,000	1,750	136	Solid*	36x3½	36x3½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell	Dual	Bosch	Hand
Modern H	3,000	1,950	136*	Solid	36x4	36x5*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Cell	Dual	Bosch	Hand
Modern M	3,000	2,000	136*	Solid	36x4	36x5*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Cell	Dual	Bosch	Hand
Moon B	3,000	1,800	125*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Gear	Cell	Dual	Remy	Hand
Moore 1½	3,000	1,950	145	Solid	37x3½	37x4	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 2	4,000	2,500	163	Solid	37x4	37x3½d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 3	6,000	3,150	142	Solid	37x5	37x4d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Moore 4	8,000	3,500	153	Solid	37x5	37x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Moore 5	10,000	4,500	175	Solid	37x6	42x6d	Under floor	4	5.25	7.00	44.20	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Moreland 7X	1,500	1,800	126	Solid*	34x3½	34x3½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	West.	Hand
Moreland 1X	3,000	2,050	120	Solid	34x3½	34x5	Under floor	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	West.	Hand
Moreland 2X	5,000	2,650	144	Solid	34x4	34x4d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Sing	West.	Hand
Moreland 3X	7,000	3,500	168	Solid	36x5	38x5d	Under floor	4	4.75	5.75	36.15	Pairs	Left	Cent	Finned	Sing	West.	Hand
Moreland 5X	10,000	4,000	168	Solid	36x6	40x6d	Under floor	4	4.75	6.75	36.15	Pairs	Left	Cent	Finned	Sing	West.	Hand
Moreland 6X	13,000	4,500	168	Solid	36x5	40x6d	Under floor	4	5.25	7.00	44.20	Pairs	Opp	Cent	Finned	Sing	Bosch	Hand
Motokart 1&2	500	365	69	Pneu.	26x2½	26x2½	Under seat	2	3.62	4.00	10.53	Sing	Head	Thermo	Sq-t	Sing	None	Hand
Natco 20	2,000	1,925	104	Solid	36x3½	36x3½	Betw seats	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	U & H	Fixed
Nelson&LeM. E1	2,000	1,800	Opt	Solid	36x3	36x4	Under hood	4	3.75	5.25	22.50	Block	L&H	Cent	Finned	Dual	Bosch	Fixed
Nelson&LeM. E1½	3,000	2,000	Opt	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Finned	Dual	Bosch	Hand
Nelson&LeM. E2	4,000	2,250	Opt	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Finned	Dual	Bosch	Hand
Netco C	3,000	2,250	144	Solid	36x3½	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
New York L	3,000	2,000	129	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Bosch	Fixed
O. K. C&D	1,200	875	112	Pneu.	33x4	33x4	Under hood	4	3.50	5.00	19.61	Block	R&H	Thermo	Z-z-t	Sing	Bosch	Fixed
Old Hickory 30W	3,000	1,900	110	Solid	33x3½	33x4	Under floor	4	3.75	5.00	22.50	Block	Right	Thermo	Z-z-t	Dual	Heinze	Hand
Old Reliable 1½	3,000	2,250	138	Solid	34x3½	36x6	Under hood	4	3.75	5.00	22.50	Block	Left	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 2	4,000	2,750	120	Solid	34x4	36x4d	Under floor	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 3	6,000	3,400	122	Solid	34x5	36x5d	Under floor	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 4	8,000	4,000	126	Solid	36x5	36x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 5	10,000	4,500	126	Solid	36x6	36x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Sing*	Bosch	Hand
Old Reliable 7	14,000	5,000	126	Solid	36x6	40x7d	Under floor	4	4.75	6.75	36.15	Pairs	Left	Cent	Sq-t	Sing*	Bosch	Hand
Overland 81	800	850-c*	106	Pneu	33x4	33x4	Under hood	4	4.00	4.50	25.60	Sing	Left	Thermo	Sq-t	Sing	Split	Hand
Packard 2	4,000	2,800	120*	Solid	34x3½	34x4d	Under hood	4	4.06	5.12	26.39	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 3	6,000	3,400	126*	Solid	36x4	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 4	8,000	3,550	126*	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 5	10,000	4,150	144*	Solid	36x6	40x6d	Under hood	4	5.00	5.50	40.00	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Packard 6	12,000	4,300	144*	Solid	36x6	42x7d	Under hood	4	5.00	5.50	40.00	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Palmer-Moore D	2,000	1,300	102	Solid	36x2½	36x3	Under hood	3	4.00	4.00	......	Sing	2-cy	Thermo	Finned	Sing	Bosch	Fixed
Paulding O	800	650	95	Pneu.	30x3	31x3½	Under hood	4	2.75	4.00	12.08	Block	R&H	Thermo	Finned	Dual	Day-D	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* **2-pt,** *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL		Pro-pulsion Taken By	Name and Model
GOVERNOR		SPEEDS		Carbur-eter Make	Lubrica-tion	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers		
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
Cent	Motor	1,230	25	Opt	Spl-press	Cone	Selec	Amid	3	5¼-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew B*
Cent	Motor	1,230	25	Opt	Spl-press	Cone	Selec	Amid	3	6 -1	Top worm	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew BW*
Cent	Motor	1,134	18	Opt	Spl-press	Cone	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew H
Cent	Motor	1,300	18	Opt	Sp'-press	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew F
Cent	Motor	1,295	15	Opt	Spl-press	Cone	Selec	Amid	3	9¼-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Lippard-Stew G
		1,200	12	Holley	Circ-spl	Wet-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Little Giant H
Ring	Motor	900	10½	Own	Spl-press	Dry-d	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Locomobile A2
Ring	Motor	900	10½	Own	Spl-press	Dry-d	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Locomobile AA2
			15	Strom	Circ-spl	Wet-d	Selec	Unit-j	3	12 -1	Dbl chn-f		½-Ell	½-Ell	Left	Cent	R-r	M&E B
			10	Strom	Circ-spl	Wet-d	Selec	Unit-m	3	14 -1	Dbl chn-f		½-Ell	½-Ell	Right	Right	R-r	M&E G
Cent	Motor	1,000	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar B
Cent	Motor	1,000	16	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Maccar E
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar C
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	8 -1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Maccar F
Cent	Motor	1,000	14	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Maccar D
None	None	1,500	15	Scheb	Circ-spl	Cone	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	McIntyre E
Suct	Motor	1,500	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	McIntyre A
Suct	Motor	1,500	6	Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	McIntyre G
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais C
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais D
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais E
L-b	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais F
L-b	Gearset	1,250	12	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais G
L-b	Gearset	1,250	12	Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais H
L-b	Gearset			Ray	Circ-spl	Exp-s	Prog	Unit-m	3		Int-g	Tor-t	½-Ell	½-Ell	Left	Left	R-r	Mais Tractor
None	None			Strom	Pressure	Dry-d	Selec	Unit-m	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Martin R
None	None			Strom	Pressure	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin S
Cent	Motor	1,000	13½	Strom	Pressure	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin E
Cent	Motor	1,000	13	Strom	Pressure	Wet-d	Selec	Unit-j	3	9¼-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Martin L
Cent	Motor	1,400	20	Strom	Spl-press	Wet-d	Selec	Unit-m	3	5¼-1	Bevel	Tor-t	½-Ell	Plat	Right	Cent	R-r	Menominee A3
Cent	F-wheel	1,200	16	Strom	Spl-press	Dry-d	Selec	Unit-m	3	7 -1	Doub-r	T-arm	½-Ell	Plat	Right	Cent	R-r	Menominee B3
Cent	F-wheel	1,400	14	Strom	Spl-press	Dry-p	Selec	Unit-m	3		Doub-r	T-arm	½-Ell	Plat	Right	Cent	R-r	Menominee C
		1,000	15	Own	Spl-press	Wet-d	Plan	Unit-m	2	8 -1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Mercury P
Cent	Motor	1,200	18	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	R-r	Modern L
Cent	Motor	1,200	16	Scheb	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn	Blank	½-Ell	½-Ell	Left	Cent	R-r	Modern H
Cent	Motor	1,200	16	Scheb	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	R-r	Modern M
				Strom	Circ-spl	Cone	Selec	Amid	3	7 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moon B
Cent	Motor	1,000	18.11	Scheb	Spl-press	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moore 1½
Cent	Motor	1,000	17.4	Scheb	Spl-press	Cone	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Moore 2
Cent	Motor	1,000	14	Scheb	Spl-press	Cone	Selec	Unit-j	3	6¼-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 3
Cent	Motor	1,000	12	Scheb	Spl-press	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 4
Cent	Motor	950	10	Scheb	Spl-press	Cone	Selec	Unit-j	4	9¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moore 5
		1,500	20	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6 -1	Top worm	R-r	½-Ell	½-Ell	Right	Cent	R-r	Moreland 7X
		1,500	18	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	R-r	½-Ell	½-Ell	Right	Cent	R-r	Moreland 1X
Cent	Motor	1,100	15	Master	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	R-r	Moreland 2X
Cent	Motor	950	12	Master	Circ-spl	Dry-d	Selec	Amid	4	10¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	R-r	Moreland 3X
Cent	Motor	950	10	Master	Circ-spl	Dry-d	Selec	Unit-j	4	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moreland 5X
Cent	Motor	900	8	Master	Pressure	Cont-b	Selec	Unit-j	4	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Moreland 6X
		1,400	28		Splash	None	Fric	Amid	Any		Sing chn		½-Ell	½-Ell	Left	Cent	R-r	Motokart 1&2
None	None	1,100	15	Zenith	Pressure	Cone	Selec	Unit-j	3	6¾-1	Dbl chn†		½-Ell	½-Ell	Left	Cent	R-r	Natco 20
Cent	Motor	950	17	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM E1
Cent	Motor	950	15	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM E1½
Cent	Motor	950	15	Ray	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Nelson&LeM E2
Cent	D-shft		15	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Netco C
Hyd	Motor	1,000	18	Strom	Spl-press	Cone	Selec	Unit-j	3	3½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	New York L
				Strom	Circ-spl	Cone	Selec	Unit-m	3	5 -1	Bevel	R-r	½-Ell	Ellip	Left	Cent	R-r	O. K. C&D
Cent	Motor	1,265	16	Holley	Spl-press	Cone	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Left	Springs	Old Hickory 30W
		1,600	16	Carter	Spl-press	Dry-d	Selec	Unit-m	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Old Reliable 1½
		1,400	15	Strom	Spl-press	Wet-d	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 2
		1,400	14	Strom	Spl-press	Wet-d	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 3
Cent	D-shft	1,400	14	Strom	Spl-press	Wet-d	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 4
Cent	D-shft	1,400	12	Strom	Spl-press	Wet-d	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 5
Cent	D-shft	1,000	10	Carter	Spl-press	Wet-d	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Old Reliable 7
				Scheb	Circ-spl	Cone	Selec	Unit-x	3	3¾-1	Bevel	Tor-t	½-Ell	¾-Ell	Left	Cent	Tor-t	Overland 81
Cent	Motor	1,000	14	Own	Splash	Dry-p	Prog	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 2
Cent	Motor	1,000	12	Own	Splash	Dry-p	Prog	Unit-j	3	11 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 3
Cent	Motor	1,000	12	Own	Splash	Dry-p	Prog	Unit-j	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 4
Cent	Motor	1,000	8½	Own	Splash	Dry-p	Prog	Unit-j	3	11¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 5
Cent	Motor	1,000	8½	Own	Splash	Dry-p	Prog	Unit-j	3	11¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Packard 6
		1,400	20	Own	Fuel-inj	Dry-d	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Palmer-Moore D
		1,500	25	Zephyr	Circ-spl	Cone	Selec	Unit-m	3		Bevel	Tor-t	½-Ell	½-Ell	Right	Cent	Tor-t	Paulding O

Carbureter Make, Strom, *Stromberg*; Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication**, Splash, *non-circulating or simple splash*; Circ-spl, *circulating-splash*; Spl-press, *splash-pressure*; Fuel-in, *fuel injection, oil mixed with fuel*; Pressure, *pressure feed, no splash*. **Clutch Type**, Dry-p, *dry plate*; Dry-d, *dry multiple disk*; Wet-d, *wet disk or disk-in-oil*; R-cone, *reversed cone or inserted cone*; Exp-s, *expanding shoe*; Cont-b, *contracting band*. **Gearset Type**, Prog, *progressive sliding gear*; Selec, *selective sliding gear* Plan, *planetary*; Ind-c, *constant-mesh individual-clutch*; Fric, *friction*; Hyd, *hydraulic*; Elec, *electric*. **Gearset Location**, mid, *amidships*; Unit-m, *unit with motor*; Unit-j, *unit with jackshaft*; Unit-x, *unit with axle*; Unit-s, *unit driveshaft*. **Final Drive**, Bevel, *direct bevel*; Doub-r, *double-reduction, bevel and spur*; Int-g, *internal gear*; Top worm, *worm gear with worm on top*; Dbl chn, *double chain*; Sing chn, *single chain*; -f, *to front wheels*; -4, *to all four wheels*. **Driving Torque**, R-r, *radius rods*; T-arm, *torque-arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*. **Springs**, Ellip, *elliptic*; ½-Ell, *half-elliptic*; ¼-Ell, *quarter-elliptic*; ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse elliptic*; Cant, *cantilever*; Comb, *combination of half-elliptic and elliptic on double frames*. **Steering**, Cent, *center*. **Levers**, Cent, *center*; C&r, *gearshift center, brake right*; C&l, *gearshift center, brake left*; St-col, *steering column* **Propulsion** R-r, *radius rods*; T-arm *torque arm*; Tor-t *torsion tube*; Sub-f, *sub-frame*.

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear	MOTOR Location	CYLINDERS No.	Bore in Ins.	Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING Water Circulation	Radiator Type	IGNITION Type	Make	Spark Advance
Paulding H	1,500	950	120	Solid	36x2½	36x3	Under hood	4	3.50	5.00	19.61	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding G	2,000	1,300	120	Solid	36x3	36x3½	Under hood	4	4.00	5.25	25.60	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding M	4,000	1,950	145	Solid	36x4	36x4d	Under hood	4	4.62	5.25	34.28	Block	R&H	Gear	Finned	Dual	Day-D	Hand
Peerless 3	6,000	3,700	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 4	8,000	4,000	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 5	10,000	4,500	151*	Solid	36x6	42x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 6	12,000	5,000	151*	Solid	36x6	42x7d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Pierce-Arrow 2	4,000	3,000	150*	Solid	36x4	36x4d	Under hood	4	4.00	5.50	25.60	Pairs	Opp	Cent	Finned	Sing	Bosch	Hand
Pierce-Arrow 5	10,000	4,500	168*	Solid	36x5	40x6d	Under hood	4	4.87	6.00	38.25	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Reo J	4,000	1,650	130*	Solid	36x4	36x3½d	Under hood	4	4.12	4.50	27.20	Pairs	R&H	Cent	Finned	Dual	Nat'l	Hand
Republic 1500	1,500	......	124	Solid*	35x3*	35x3½*	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Republic 1	2,000	1,350	124	Solid	35x3	35x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Republic 1½	3,000	1,475	144	Solid	35x3½	35x5*	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Reland 1	2,000	2,000	120	Solid	34x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Reland 3	6,000	3,500	144	Solid	36x5	36x5d	Under hood	4	4.25	6.75	29.00	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Reland 3½	7,000	3,500	156	Solid	36x5	40x5d	Under hood	4	4.50	6.75	32.40	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Rowe CW	3,000	2,450	144	Solid	34x3½	36x3d	Under hood	4	4.00	5.00	25.60	Block	....	Thermo	Sq-t	Dual	Bosch	Hand
Rowe DW	4,000	2,800	150	Solid	36x4	36x4d	Under hood	4	4.25	5.00	29.00	Pairs	....	Cent	Sq-t	Dual	Bosch	Hand
Rowe EW	6,000	3,400	156	Solid	36x5	40x5d	Under hood	4	4.00	5.50	25.60	Pairs	....	Cent	Sq-t	Dual	Bosch	Hand
Rowe GW	10,000	4,500	171	Solid	36x6	40x6d	Under hood	4	4.75	5.50	36.15	Pairs	....	Cent	Sq-t	Dual	Bosch	Hand
Royal B3½	7,000	3,400	132	Solid	36x5	40x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Royal A5	10,000	4,500	138	Solid	36x6	40x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Sandow 1½	3,000	1,900	125*	Solid	36x3	36x4	Under hood	4	3.75	5.25	22.50	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 2	4,000	2,250	125*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 3	6,000	3,000	147*	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	L&H	Gear	Cell	Dual	Bosch	2-pt
Sanford O	1,500	1,290	120	Solid*	36x3*	36x3½*	Under hood	4	3.50	5.12	19.61	Block	Right	Thermo	Finned	Sing	Split	Fixed
Sanford K	3,000	1,660	106	Solid	36x3½	36x3½	Under floor	4	4.00	4.50	25.60	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford L	4,000	1,910	118	Solid	36x3½	36x4	Under floor	4	4.12	5.00	27.20	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford M	4,000	1,910	140	Solid	36x3½	36x5	Under hood	4	4.12	5.00	27.20	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Saxon A2	400	395-c	96	Pneu	28x3	28x3	Under hood	4	2.62	4.00	11.23	Block	Left	Thermo	Cell	Sing	Atw-K	Auto
Selden JB	3,000	2,000	150	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Service W	2,000	2,000	135*	Solid	36x3½	36x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Service Q	3,000	1,975	150	Solid	36x3½	36x5	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service P	4,000	2,375	150	Solid	36x4	40x3½d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service PW	4,000	2,500	160	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service H	6,000	2,975	171	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service HX	10,000	4,000	175*	Solid	36x6	40x6d	Under hood	4	4.75	6.75	36.15	Block	Right	Cent	Cell	Dual	Eisemann	Hand
Signal D	2,000	1,400	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal DL	2,000	1,450	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal F	2,000	1,500	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal FL	2,000	1,550	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Smith A	7,000	3,750	168	Solid	36x5	36x5d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
Smith C	12,000	4,750	168	Solid	36x6	40x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
South Bend 40	4,000	2,000	136*	Pneu*	36x4½*	36x4½*	Under hood	4	4.00	5.00	25.60	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
South Bend 80	8,000	3,000	152	Pneu*	39x6*	39x6*	Under hood	4	5.25	7.00	44.20	Pairs	Opp	Cent	Sq-t	Dual*	Bosch*	Hand
Speedwell 8Y	4,000	2,850	115	Solid	36x4	36x3½d	Under floor	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 10Z	8,000	3,750	115	Solid	36x5	36x5d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 8X	12,000	4,400	139	Solid	36x6	36x6d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Standard-D 3	6,000	2,750	144	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-D 7	14,000	3,300	112	Solid	40x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-O DX	1,500	1,700	......	Pneu	34x4½	34x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Standard-O A	2,000	1,700	134	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O AX	2,000	1,900	124*	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Standard-O B	3,000	1,800	134*	Solid*	37x4½*	36x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O BX	3,000	2,100	134*	Solid*	37x4½*	36x5	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O C	4,000	2,000	144*	Solid*	37x5*	36x5*	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Fixed
Standard-O CX	7,000	3,200	162	Solid	36x5	36x5d	Under hood	4	4.37	6.00	30.65	Pairs	Right	Cent	Z-z-t	Sing	Eisemann	Hand
Stegeman	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	3,000	2,100	150	C&S	34x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	5,000	2,800	142*	Solid	34x3½	36x3½db	Under hood	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	7,000	3,350	155*	Solid	36x4	40x4db.	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	10,000	4,200	168	Solid	36x6	40x6db.	Under hood	4	4.50	6.75	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Sternberg	1,000	850-c	88	Pneu	30x4	30x4	Under hood	4	2.75	4.00	12.08	Block	Right	Thermo	Sq-t	Sing	Eisemann	Hand
Sternberg	4,000	2,800	148*	Solid	36x5	36x3½d*	Under hood	4	3.75	5.75	22.50	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	6,000	3,400	158*	Solid	36x6	36x4d*	Under hood	4	4.25	5.75	29.00	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	10,000	4,500	......	Solid	38x6	40x6d	Under hood	4	4.50	5.75	32.40	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	12,000	4,650	144	Solid	38x6	42x6d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Sternberg	14,000	4,750	144	Solid	38x7	42x7d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Stewart-B	1,500	1,500	124	Pneu	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Cell	Sing	Bosch	Fixed
Stewart-K C	2,000	1,100	96	Solid	36x3	36x3	Under seat	2	5.00	5.50	20.00	Sing	Head	Cent	Finned	Dual	King	Hand
Studebaker 5	1,500	985	108	Pneu	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Left	Cent	Finned	Dual	....	Hand
Sullivan G	3,000	1,600	129	Solid	36x3	36x4	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Tiffin A	1,500	1,600	112	Solid	34x3	34x3	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind**, Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes**, d, *dual.* **Motor Location**, Betw seats, *between seats.* **Cylinder Cast**, Sing, *singly or individually.* **Location of Valves**, Opp, *opposite, or T-head type;* Top (2-cylinder motors, only), *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation**, Cent, *centrifugal, pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type**, Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type**, Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking devices), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance**, Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type**, Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive**, Motor, *from motor;* D-shft *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
				Scheb	Circ-spl	Cone	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Paulding H**
		1,800	30	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	**Paulding G**
				Scheb	Circ-spl	Dry-d	Selec		3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	**Paulding M**
Cent	Motor	925	14¾	Peerless	Splash	Cone	Selec	Amid	4	7½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Peerless 3**
Cent	Motor	925	12¾	Peerless	Splash	Cone	Selec	Amid	4	8¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Peerless 4**
Cent	Motor	925	10¾	Peerless	Splash	Cone	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Peerless 5**
Cent	Motor	925	10	Peerless	Splash	Cone	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Peerless 6**
Cent	Motor	1,050	16	Own	Pressure	Cone	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	**Pierce-Arrow 2**
Cent	Motor	950	14	Own	Pressure	Cone	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	**Pierce-Arrow 5**
Hyd	Motor	1,200	12	Holley	Circ-spl	Dry-d	Selec	Amid	3	8¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Reo J**
Suct	Motor	1,050	18	Strom	Spl-press	Dry-d	Selec	Unit-m	3	6¾-1	Int-g	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Republic 1500**
Suct	Motor	1,000	15	Strom	Spl-press	Cone	Selec	Unit-j	3	7¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Republic 1**
Suct	Motor	1,000	15	Strom	Spl-press	Cone	Selec	Unit-j	3	7¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Republic 1½**
None	None	1,500	18	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	**Roland 1**
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Top worm	Springs	Ellip	Ellip	Left	Left	Springs	**Roland 3**
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	**Roland 3½**
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		**Rowe CW**
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		**Rowe DW**
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		**Rowe EW**
				Ray	Pressure	Wet-d			3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		**Rowe GW**
L-b	Motor	900	15	Strom	Pressure	Wet-d	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Royal B3½**
L-b	Motor	900	12	Strom	Pressure	Wet-d	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Royal A5**
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Sandow 1½**
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Sandow 2**
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Sandow 3**
		1,100	18	Muir	Circ-spl	Dry-d	Selec	Unit-m	3	7 -1	Int-g	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Sanford O**
Cent		1,100	16	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Sanford K**
Cent	Motor	1,100	14	Scheb	Circ-spl	Wet-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Sanford L**
Cent	Motor	1,100	14	Scheb	Circ-spl	Dry-d	Selec	Unit-m	3	7 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Sanford M**
		1,600	40	Mayer	Splash	Dry-p	Prog	Unit-x	2	4¾-1	Bevel	Tor-t	¼-Ell	½-Ell	Left	Cent	Tor-t	**Saxon A2**
Cent*	Motor	1,150	16	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Selden JB**
Cent*	Motor	1,000	16	Strom	Spl-press	Cone	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Service W**
Cent*	Motor	1,000	14	Strom	Spl-press	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Service Q**
Cent*	Motor	1,000	12	Strom	Spl-press	Cone	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Service P**
Cent*	Motor	1,000	14	Strom	Pressure	Cone	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Service PW**
Cent*	Motor	1,000	11	Strom	Spl-press	Cone	Selec	Unit-j	3	8¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Service H**
Cent	Motor	870	12	Strom	Spl-press	Cone	Selec	Unit-j	4	6¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Service HX**
Suct	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Signal D**
Suct	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Signal DL**
Suct	Motor	1,200	15	Strom	Circ-spl	Dry d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Signal F**
Suct	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Signal FL**
Suct	Motor	900	12	Strom	Circ-spl	Dry-d	Ind-c	Unit-s	3	8½-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	**Smith A**
Suct	Motor	1,000	9	Strom	Circ-spl	Dry-d	Ind-c	Unit-s	3	8½-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	**Smith C**
Suct	F-wheel	1,800	25	Strom	Spl-press	Wet-d	Selec	Unit-j	3	4 -1	Dbl chn		½-Ell	½-Ell	Opt	Opt	R-r	**South Bend 40**
Suct	F-wheel	1,400	30	Strom	Spl-press	Wet-d	Selec	Unit-j	3*	4 -1	Dbl chn		½-Ell	½-Ell	Right	R&C	R-r	**South Bend 80**
Cent	Motor	1,100	15	Scheb	Circ-spl	Cone	Selec	Amid	3	9½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Speedwell 8Y**
Cent	Motor	1,200	12	Scheb	Circ-spl	Cone	Selec	Amid	3	10¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Speedwell 10Z**
Cent	Motor	1,200	10	Scheb	Circ-spl	Cone	Selec	Amid	3	10¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Speedwell 8X**
Suct	Motor	1,200	12	Strom	Circ-spl	Dry-d	Prog	Unit-m	3	9 -1	T-worm*	T-arm*	½-Ell	½-Ell	Left	Cent	Springs*	**Standard-D 3**
Suct	Motor	1,200	10	Strom	Circ-spl	Dry-d	Prog	Unit-m	3		Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Standard-D 7**
L-b	Motor			Strom	Circ-spl	Dry-d	Selec	Amid	3	5¼-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Standard-D DX**
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Standard-O A**
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Standard-O AX**
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Standard-O B**
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Standard-O BX**
L-b	Motor	1,250	18	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Standard-O C**
L-b	Motor	1,000	14	Scheb	Circ-spl	Dry-d	Selec	Amid	3	8¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	**Standard-O CX**
Cent	Motor	1,100	20	Carter	Spl-press	Dry-d	Selec	Unit-m	3	6 -1	Bevel	R-r	½-Ell	½-Ell	Left	Cent	R-r	**Stegeman**
Cent	Motor	1,100	18	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Stegeman**
Cent	Motor	1,100	15	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8¼-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Stegeman**
Cent	Motor	1,100	12	Carter	Spl-press	Dry-d	Selec	Unit-m	3	11¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Stegeman**
Cent	Motor	1,100	10	Carter	Spl-press	Dry-d	Selec	Unit-m	3	14½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Stegeman**
None	None	1,500	19		Spl-press	Cone	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Sternberg**
Cent	Motor	1,020	14	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Sternberg**
Cent	Motor	1,020	13	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Sternberg**
Cent	Motor	1,000	11	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Sternberg**
Cent	Motor	950	10	Holley	Circ-spl	Wet-d	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Sternberg**
Cent	Motor	950	10	Holley	Circ-spl	Wet-d	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Sternberg**
Cent	Motor		30	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	5¼-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Stewart-B**
		600	18	Scheb	Spl-press	Wet-d	Plan	Unit-m	2		Dbl chn		½-Ell	½-Ell	Left		R-r	**Stewart-K C**
			20	Scheb	Circ-spl	Cone	Selec	Unit-x	3	4⅝-1	Bevel	T-arm	½-Ell	Ellip	Left*	Cent*	R-r	**Studebaker S**
Cent	Motor	1,350	18	Holley	Circ-spl	Cone	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Sullivan G**
None	None			Breeze	Circ-spl	Cone	Selec	Unit-j	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Tiffin A**

Carburetor Make, Strom, *Stromberg*; Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication**, Splash, *non-circulating or simple splash*; Circ-spl, *circulating-splash*; Spl-press, *splash-pressure*; Fuel-inj, *fuel injection, oil mixed with fuel*; Pressure, *pressure feed, no splash*. **Clutch Type**, Dry-p, *dry plate*; Dry-d, *dry multiple disk*; Wet-d, *wet disk or disk-in-oil*; R-cone, *reversed cone or inverted cone*; Exp-s, *expanding shoe*; Cont-b, *contracting band*. **Gearset Type**, Prog, *progressive sliding gear*; Selec, *selective sliding gear*; Plan, *planetary*; Ind-c, *constant-mesh individual-clutch*; Frc, *friction*; Hyd, *hydraulic*; Elec, *electric*. **Gearset Location**, Amid, *amidships*; Unit-m, *unit with motor*; Unit-j, *unit with jackshaft*; Unit-x, *unit with axle*; Unit-s, *unit driveshaft*. **Final Drive**, Bevel, *direct bevel*; Doub-r, *double-reduction, bevel and spur*; Int-g, *internal gear*; Top worm, *worm gear with worm on top*; Dbl chn, *double chain*; Sing chn, *single chain*; -f, *to front wheels*; -4, *to all four wheels*. **Driving Torque** R-r, *radius rods*; T-arm, *torque-arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*. **Springs**, Ellip, *elliptic*; ½-Ell, *half-elliptic*; ¼-Ell, *quarter-elliptic*; ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse elliptic*; Cant, *cantilever*; Comb, *combination of half-elliptic and elliptic; on double frames*. **Steering**, Cent, *center*. **Levers**, Cent, *center*; C&R, *gearshift center, brake right*; C&L, *gearshift center, brake left*; St-col, *steering column*. **Propulsion**, R-r, *radius rods*; T-arm, *torque arm*; Tor-t *torsion tube*; Sub-f, *sub-frame*.

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Tabulated Specifications of 377 Different Models and Capa

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
Tiffin G	2,000	2,000	128	Solid	36x3½	36x4	Under hood	4	3.75	4.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Hand
Tiffin M	4,000	2,700	140	Solid	36x4	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Hand
Trabold T	2,000	1,250	118	Solid	36x3	38x3½	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Cell.	Dual	Briggs	Hand
Trabold	4,000	2,450	130	Solid	36x4	38x3d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell.	Dual	West.	Hand
Trabold	6,000	3,300	130	Solid	36x4	38x4d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell.	Dual	West.	Hand
Trumbull 15D	500	395-c	80	Pneu	28x3	28x3	Under hood	4	2.87	4.00	13.37	Block	Right	Thermo	Finned	Sing	Split	Fixed
Universal C	3,000	1,950	132	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Thermo	Finned	Sing	Eisemann	Hand
Universal A	6,000	3,400	132	Solid	36x5	36x4d	Under floor	4	4.00	5.50	25.60	Pairs	Opp	Cent	Cell.	Dual	Eisemann	Hand
U. S. E	4,000	2,550	132	Solid	34x3½	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. G	5,000	2,750	138	Solid	34x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. D	6,000	3,200	144	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. F	8,000	3,550	156	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Velie X	2,000	2,000	129*	Solid*	36x3½*	36x4	Under hood	4	4.62	5.25	34.28	Pairs	Left	Cent	Cell.	Dual	Bosch	Fixed
Velie U	3,000	2,250	140	Solid	36x4	36x5*	Under hood	4	4.62	5.25	34.28	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie	5,000	2,850	148*	Solid	36x4	36x4d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie Z	8,000	3,350	148*	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell.	Dual	Bosch	Fixed
Velie ZS	10,000	3,750	148*	Solid	36x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell.	Dual	Bosch	Fixed
Vim L&F	1,000	620	94	Pneu	30x3½	30x3½	Under hood	4	3.00	4.50	14.40	Block	Right	Thermo	Finned	Sing	Atw-K	Hand
Vulcan 2	5,000	2,750	150*	Solid	36x4	30x3½d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell.	Dual-d	Bosch	Hand
Vulcan 3	7,500	3,250	156*	Solid	36x5	34x4d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell.	Dual-d	Bosch	Hand
Vulcan 4	9,200	4,000	162	Solid	35x5	35x5d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell.	Dual-d	Bosch	Hand
Vulcan 5	11,500	4,500	162	Solid	36x6	36x6d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell.	Dual-d	Bosch	Hand
Vulcan 7	15,500	6,000	156*	Solid	36x7	42x7d	Under hood	4	4.75	5.50	36.15	Pairs	Left	Gear	Cell.	Dual-d	Bosch	Hand
Wagenhals	800	690-c	80	P&C	30x3	34x4½	Under hood	4	3.50	3.37	19.61	Pairs	Back	Gear	Finned	Dual		Hand
Walter 5	10,000	4,500	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 6	12,000	4,750	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 7½	15,000	5,000	144	Solid	40x6	40x6d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter Tractor	24,000	4,500	108	Solid	40x4d	40x4d	Under hood	4	4.37	6.00	30.65	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Ware	6,000			Solid			Under hood	4	4.00	5.50	25.60	Pairs		Gear			Mea	
White GBBE	1,500	2,100	133½	Pneu	34x4½	34x4½	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell.	Sing	Bosch	Hand
White TBC	3,000	3,000	145½	Pneu	36x4½	36x4½d	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell.	Sing	Bosch	Hand
White TAD	6,000	3,700	163	Solid	36x5	40x5d	Under hood	4	3.75	5.12	22.50	Block	Left	Cent	Cell.	Sing	Bosch	Hand
White TCD	10,000	4,500	165	Solid	36x5	40x6d	Under hood	4	4.25	6.37	29.00	Block	Left	Cent	Cell.	Sing	Bosch	Hand
Wichita A	2,000	1,650	110	Solid	34x3	34x4	Under hood	4	3.25	5.00	16.92	Block	L&H	Thermo	Cell.	Sing	Bosch*	Hand
Wichita B	4,000	2,100	118	Solid	34x3½	34x3d	Under hood	4	3.50	5.00	19.61	Block	L&H	Thermo	Cell.	Sing	Bosch*	Hand
Wichita H	7,000	3,250	165	Solid	36x5	36x5d	Under hood	4	4.25*	6.75	29.00*	Pairs	L&H	Cent	Cell.	Dual	Bosch	Hand
Wilcox T	1,000	1,000	115	Pneu	33x4	33x4	Under hood	4	3.50	5.00	19.61	Block		Thermo	Z-z-t	Sing	Mea	Hand
Wilcox LA	2,000	2,000	132	Solid*	36x3½*	36x5d*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Z-z-t	Sing	Mea	Hand
Wilcox NA	4,000	2,500	118	Solid	36x4	36x3½d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-z-t	Dual	Bosch	Hand
Wilcox JA	6,000	3,250	128	Solid	36x5	36x4d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-z-t	Dual	Bosch	Hand
Willet M	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet L	4,000	2,600	144	Solid	36x4	36x4½b.	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet K	6,000	2,800	144*	Solid	36x4	36x4db.	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Finned	Sing	Eisemann	Auto
Wilson B	4,000	1,800	130*	Solid	37x3½	37x5	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Willys 65	1,500	1,350	120	P&S	34x4½	36x3½	Under hood	4	4.12	4.50	27.20	Sing	Left	Thermo	Finned	Dual	Split	Hand

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Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	Kind	Front	Rear	Location	No.	Bore in Ins.	Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Water Circulation	Radiator Type	Type	Make	Spark Advance
Handy Wagon, Jr.	500	390	65	Solid	34x1½	34x1½	Under body	2	3.75	3.75	11.25	Sing	R&H	Air		Sing	None	Hand
Handy Wagon	800	487.50	77	Solid	34x1¾	34x1¾	Under body	2	4.12	3.75	13.60	Sing	R&H	Air		Sing	None	Hand
Handy Wagon, Sr.	1,200	600	86	Solid	34x1¾	34x2	Under body	2	4.75	4.75	18.10	Sing	R&H	Air		Sing	Briggs	Hand
Hurlburt 1	2,000	1,500	120	Pneu	34x4½	34x4½	Under hood	4	3.75	4.50	22.50	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 2	4,000	3,000	Opt	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 3½	7,000	3,500	Opt	Solid	36x5	36x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Locomobile 3	6,000	3,500	150*	Solid	36x5	36x5d	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell.	Dual	Eisemann	Hand
Locomobile 4	8,000	3,600	150*	Solid	36x5	36x6d	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell.	Dual	Eisemann	Hand
C. T. Tractor	10,000	4,750	155	Solid	36x4d	36x5d	Under seats	4	4.00	6.00	25.60	Sing	R&h	Cent	Sq-t	Sing	Mea	2-pt
Transit E	2,000	2,000	120*	Solid	36x4	36x3½d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit F	4,000	2,850	144	Solid	36x4	36x4d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit T	7,000	3,500	144	Solid	36x5	36x5d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit V	10,000	4,500	144*	Solid	36x6	40x6d	Betw. seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Dispatch L	1,200	900	120	Pneu	36x3½	36x3½	Under hood	4	3.75	5.00	22.50	Block	Left	Thermo	Cell.	Dual	Bosch	Hand
Morton 1½	3,000			Solid	34x4	38x5	Under seat	4	3.75	5.25	22.50	Pairs	Opp		Cell.	Dual	Bosch	Hand
Morton 2	4,000		140	Solid	36x5	38x6		4	4.50	5.50	30.65	Pairs		Cent		Dual	Bosch	Hand
Morton 2½	5,000		140	Solid	36x5	38x6	Under seat	4	4.50	5.50	30.65	Pairs		Cent	Cell.	Dual	Bosch	Hand
Morton 3	6,000		112	Solid					4.75	6.75								
Morton 3½	7,000			Solid	38x6	40x6d		4	5.00	5.75	40.00	Pairs	Opp		Cell.		Bosch	Hand
Morton 5	10,000			Solid	38x7	42x7d		4	5.25	5.75	42.20	Pairs	Opp		Cell.	Dual	Bosch	Hand
Morton 6	12,000		140	Solid					5.50	7.00								
Morton Tractor	20,000		108	Solid	40x6	40x6db		4	5.50	7.00	48.48	Sing			Cell.	Dual	Split	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind**, Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes**, d, *dual.* **Motor Location**, Betw seats, *between seats.* **Cylinder Cast**, Sing, *singly or individually.* **Location of Valves**, Opp, *opposite, or T-head type;* Top (2-cylinder motors only). *L-head cylinder laid horizontal with valves up;* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation**, Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water* **Radiator Type**, Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-z-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type**, Sing, *single;* Doub, *double;* Dual-d, *dual-double* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance, Auto**, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type**, Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive**, Motor, *from motor;* D-shft, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

Courtesy of The Commercial Vehicle.

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cities of Motor Trucks Now Built by American Manufacturers

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin G
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8⅞-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin M
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold T
None	None			Strom	Circ-spl	Dry-p	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None		50	B-Z	Circ-spl	Cone	Selec	Unit-x	3	3⅔-1	Bevel	Tor-t	I-½ Ell	Cant	Left	Cent	Tor-t	Trumbull 15D
Cent	Motor	1,050	15	Breeze	Circ-spl	Dry-p	Selec	Unit-m	3	7¼-1	Top worm	R-r	½-Ell	½-Ell	Left	Cent	R-r	Universal C
Cent	Motor	1,000	11½	Breeze	Circ-spl	Dry-d	Selec	Unit-j	3	10¼-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Universal A
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. E
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. G
Cent	Motor	1,092	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. D
Cent	Motor	1,092	12	Strom	Circ-spl	Cone	Ind-c	Amid	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. F
Suct	Motor	900	18	Strom	Circ-spl	Dry-p	Selec	Amid	3	7¼-1	Doub-r	T-arm	½-Ell	½-Ell	Left	Cent	T-arm	Velie X
Suct	Motor	1,000	17	Strom	Circ-spl	Dry-p	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Velie U
Cent	Motor	1,000	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	8⅓-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-p	Selec	Amid	3	10 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie Z
Cent	Motor	1,000	8	Strom	Circ-spl	Dry-p	Selec	Amid	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie ZS
			25	Carter	Splash	Cone	Selec	Unit-m	3	4¼-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	Vim L&F
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 2
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 3
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9⅛-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 4
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9⅛-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 5
Cent	Motor	1,250	13½	Strom	Circ-spl	Cone	Prog	Unit-j	4	11⅓-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 7
None	None	1,800	30	Marvel	Circ-spl	Wet-d	Plan	Unit-m	2	6 -1	Sing chn		½-Ell	½-Ell	Cent	None	R-r	Wagenhals
Cent	Motor	1,000	14	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 5
Cent	Motor	1,000	12	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 6
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 7½
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter Tractor
Cent	Motor	1,100				Wet-d			4		Bevel-4			Plat		Right		Ware
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Bevel	Springs	½-Ell	½-Ell	Left	C&l	R-r	White GBBE
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Doub-r	Springs	½-Ell	½-Ell	Left	C&l	R-r	White TBC
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TAD
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TCD
		1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	7⅞-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita A
None	None	1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	8¼-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita B
Cent	Motor	1,500	11	Strom	Circ-spl	Cone	Selec	Unit-j	3	9⅝-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wichita H
Cent	Motor	1,100			Circ-spl	Dry-d	Selec	Unit-m			Bevel	Tor-t	½-Ell	¾-Ell	Left	Cent	Tor-t	Wilcox T
Cent	Motor	1,100	16		Circ-spl	Cone	Selec	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wilcox LA
Cent	Motor	1,100	14		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox NA
Cent	Motor	1,100	13		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox JA
		1,004	20	Zenith	Spl-press	Cone	Selec	Amid	3	5⅞-1	Doub-r	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Willet M
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet L
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet K
Cent	Motor	1,000	15	Marvel	Pressure	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wilson B
Cent	Motor	1,150	18	Scheb	Circ-spl	Cone	Selec	Unit-j	3	6⅝-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Willys 65

Received Too Late to Classify

				King	Splash	Dry-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Jr.
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Sr.
Cent	Motor	1,250	18	Flech	Spl-press	Dry-d	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Hurlburt 1
Cent	Motor	1,250	15	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 2
Cent	Motor	1,250	13	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 3½
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 3
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 4
Cent	Motor	1,350	13	Strom	Circ-spl	None	Elec	Unit-m	2	20¼-1	Doub-r	Springs	½-Ell	½-Ell	Left		R-r	C. T. Tractor
Cent	Motor	1,200	15	Ray	Splash	Wet-d	Selec	Unit-j	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit E
Cent	Motor	1,200	14	Ray	Splash	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit F
Cent	Motor	1,200	12	Ray	Splash	Wet-d	Selec	Unit-j	3	10 -1	Dbl chn		½-Ell	½ Ell	Right	Right	R-r	Transit T
Cent	Motor	1,200	10½	Ray	Splash	Wet-d	Selec	Unit-j	3	13 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit V
Suct	Motor	1,500	25	Ray	Press	None	Fric	Amid	5		Dbl chn		Ellip	Ellip	Right	Cent	R-r	Dispatch L
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 1½
L-b	Motor			Carter	Spl-press	Wet-d	Selec		3		Top worm		½ Ell	½-Ell	Right	Right		Morton 2
L-b	Motor			Strom*	Spl-press	Wet-d	Selec		3		Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Springs	Morton 2½
							Selec		4		Top worm4							Morton 3
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 3½
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 5
							Selec		4		Top worm4							Morton 6
			14		Spl-press	Wet-d	Selec		3		Top worm							Morton Tractor

Carbureter Make, Strom. *Stromberg* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *Electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-x, *unit with axle;* Unit-s, *unit driveshaft.* **Final Drive,** Bevel, *direct bevel;* Doub-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic;* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left;* St-col, *steering column.* **Propulsion,** R-r, *radius rods;* T-arm, *torque arm;* Tor-t, *torsion tube;* Sub-f *sub-frame.*

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E. V. A. OFFICERS DINE F. W. SMITH.

Frank W. Smith, who recently retired as president of the Electric Vehicle Association of America, was the guest of honor at a dinner given by the association's officers and directors at Delmonico's, New York City, last month. A feature of the dinner was a series of lantern slides that illustrated different stages of Mr. Smith's career, which were exhibited during an address by John F. Gilchrist of the Commonwealth Edison Company, Chicago, who succeeded Mr. Smith as president of the association. J. W. Lieb, vice president of the New York Edison Company, New York City, addressed the gathering on the part the central station has had in the development of electric vehicles. The third address was delivered by James H. McGraw of the McGraw Publishing Company, New York City.

The following were present: Past President Frank W. Smith, President John F. Gilchrist, Vice President, W. H. Johnson, J. W. Lieb, Day Baker, W. H. Blood, Jr., Charles H. Miles, J. A. Hunnewell, Harvey Robinson, A. Jackson Marshall, H. M. Edwards, W. P. Kennedy, Arthur Williams, James H. McGraw, W. H. Onken, H. C. Cushing, Jr., F. W. Frueauff, P. D. Wagoner, R. L. Lloyd, W. G. Bee, W. C. Andrews, J. W. Brennan, J. F. Becker, C. D. Marsh, A. L. Salts, T. A. Carter and T. E. Murray.

COMPETITION FOR NEW YORK 'BUSES.

The People's Five-Cent 'Bus Corporation proposes to establish electrically operated 'buses, with women as conductors, along Broadway and over the same routes followed now by the Fifth Avenue Coach Company, with a transfer service for passengers and their baggage between the Pennsylvania station and the Grand Central Terminal, New York City. The company has applied for a franchise, one of the provisions being that 2½ per cent. of gross receipts be turned over to the city, whereas the Fifth Avenue Coach Company turns over 5 per cent. In view of the fact that the new company proposes to charge only five cents for fare, and the Fifth Avenue Company receives 10 cents, the former company declares the arrangement to be equitable. The proposal is before the board of estimate for consideration.

PACKARD'S RESEARCH ENGINEER.

After serving in the engineering department of the Packard Motor Car Company, Detroit, Mich., for several years, G. L. McCain has been appointed the company's research engineer, with W. T. Hunt, another Packard engineer, as his assistant.

R. H. Henderson is now distributor for Moore and Commerce trucks, as sales manager for the Pacific Metal Products Company, Los Angeles, Cal.

GENERAL MOTORS' FUTURE BRIGHT.

The General Motors Company, New York City, is reported to be in position to meet the situation when the voting trust under which it has been operating expires by limitation on Oct. 1. One proviso is that all of the 6 per cent. notes shall have been met by that time. At the close of the fiscal year, July 31, only $7,852,000 were outstanding from the original note issue of $15,000,000. The sinking fund maturities have been reported as being taken care of, no more remaining. It is stated that it would not require financial strain to cut these outstanding notes down to $5,000,000 before maturity, the balance being provided for through issuance of additional preferred stock. At the close of the selling season, June 1, it is estimated that the company will have a cash balance of between $13,000,000 and $15,000,000 which might be used to further reduce the notes. Should the company earn 35 per cent. or more this year, it is expected that the General Motors common stockholders will demand a division of profits. The market price of the common will be governed accordingly.

MOTOR TRUCKS AND THE FARM.

Through its influence in the development of good roads, the motor truck is proving a more beneficial factor in the rehabilitation of the farms in the older settled rural districts than any trolley extension campaign ever inaugurated. Manufacturers and legislatures are working together, the former improving the trucks, reducing cost of operation and thereby extending its range of activities, and the latter passing bills in many states for the improvement of highways for the benefit of motor truck shippers, as well as the pleasure car owners.

Improved highways provide the greatest factor in reduction of cost, and it is toward this end that the Massachusetts Legislature is working in its provision for improved roads in the rural districts of that state so that ultimately, it is expected, there will be no vacant or poorly-conducted farms lying within such a distance of a market that can be reached profitably by motor trucks.

GRAMM MOTOR'S BIG ORDER.

The Gramm Motor Truck Company, Lima, O., is said to have received an order for more than 2000 1500-pound Willys-Utility trucks, the majority of which are destined for the Russian government. It is expected that the plant will be kept running at full capacity for the remainder of the year on this order.

The advertising department of the Timken-Detroit Axle Company, Detroit, Mich., is now being conducted by Frank S. Sims. The former manager, E. A. Walton, has resigned.

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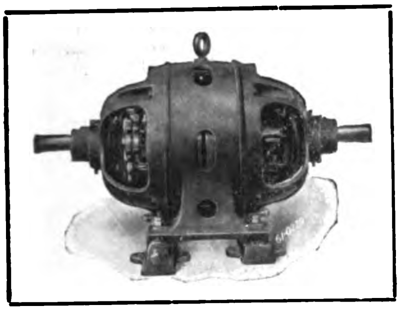
ELECTRIC VEHICLE PRACTISE.

Wagner Single-Phase Converter—Its Characteristics of Design and Its Utilities for Battery Charging and Power Production—Allen-Bradley Compression Type Rheostats and Unit Panel Switchboard for Garage Installations.

By William W. Scott.

CONSIDERATION of battery charging equipment would not be complete without a brief review of the rotary converter, which can be used to excellent advantage in private garages, or where a single vehicle is to be charged, and yet in some service stations and garages they are installed in groups and with them a number of batteries can be energized. A very interesting type is that made by the Wagner Electric Manufacturing Company, St. Louis, Mo., which is a single-phase machine and though primarily intended to convert alternating current to direct current, it may be utilized as a power motor. That is, when desired it may be used for producing power, as during the day, and at night it will serve equally well for battery charging.



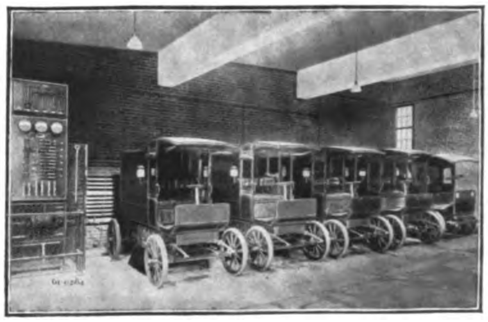
The Single-Phase Wagner Converter.

Though the dynamo is usually accepted as a producer of electrical energy from mechanical power, the term is equally well applied to either motor or generator. Any electric motor can be run as a generator, a permanent translation being made by changing the position of the brushes, although the reader has seen how some machines, by varying the wiring connections, can be operated either as a motor or a generator. This change from the one function to the other is accomplished in the Wagner converter. The possibilities of this machine for other purposes are numerous, but these are of no especial interest to the vehicle owner or operator.

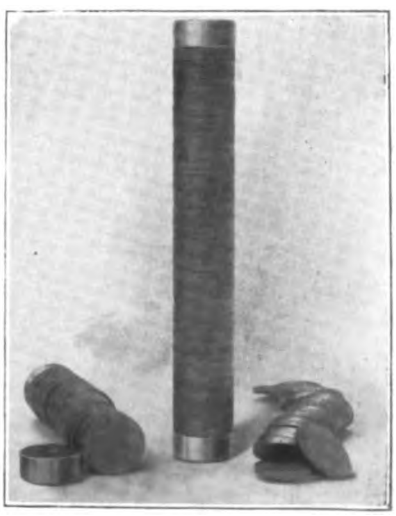
Wagner Converter Set in the Fleishman Garage, Washington, D. C.

The Wagner single-phase converter can be operated from the usual alternating current lighting circuit, which obviates any special wiring when it is utilized, and lessens the cost of installation. It is specially designed to adapt it for the higher frequencies of lighting circuits, and in this it differs from other types of converters that have been perfected for other work. The Wagner construction combines the motor and the generator of the motor-generator into one machine. The field winding of this converter instead of being similar to the usual types, with projecting poles, is wound similar to the field or stator of a single-phase motor, and in addition to this it has a compensating winding to produce sparkless commutation of the current.

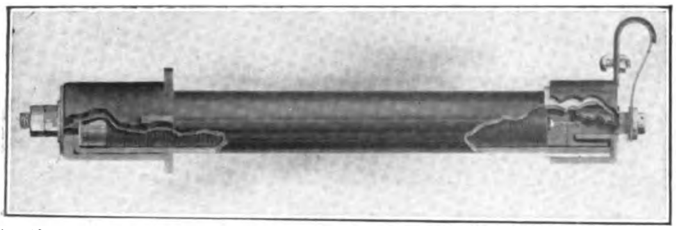
The rotor or armature is the same as that of a direct current motor, save that taps are brought out from the winding at points 180 degrees apart and carried to slip rings. Upon these slip rings rest the brushes to which the single-phase alternating current leads are attached. The converter is in appearance much like the familiar direct current motor. There is a definite ratio existing between the direct current voltage of the converter and the alternating current voltage that is supplied to it. That the direct current voltage may be sufficient for the service required, a small transformer is supplied with the converter to reduce the voltage of alternating current supply. A charging panel is necessary that includes the switches and necessary instruments. That the variable voltage necessary for battery charging may be supplied, the transformer, which is mounted on the back of the operating panel, is supplied with several taps. Leads from these taps are carried to a



Delivery Wagons Charged by Wagner Single-Phase Converters in the Fleishman Garage.



Column of Resister Discs Used in an Allen-Bradley Resistance Unit.



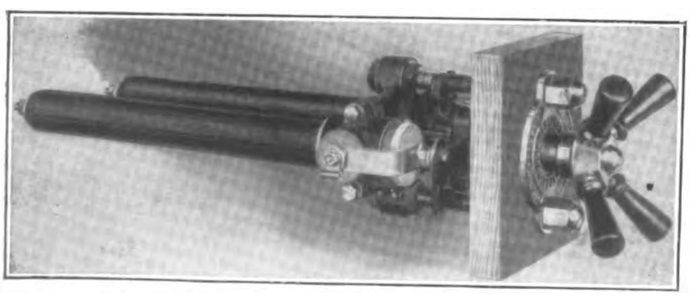
Section of the Allen-Bradley Resistance Unit Without Radiation Fins.

switch on the operating panel, so that any desired voltage may be supplied to the slip rings of the converter and thence to the battery. On the panel are mounted the starting switch and the protective fuse. As additional protection and to facilitate the operation of the converter reverse current and maximum voltage relays may be supplied, the former to prevent the battery from returning current to the converter in the event the voltage of the alternating current supply should fail, and the latter to cut out the battery from the converter when the battery is completely charged.

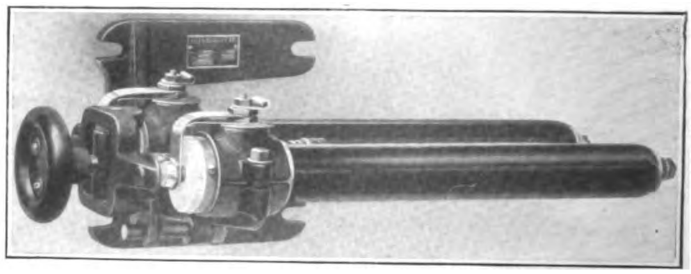
These relays are so connected with the circuit breaker that both the alternating and the direct current circuits are opened when either of the relays operate, disconnecting the battery from the converter and the converter from the line. In the event the vehicle to be charged is not equipped with instruments, instruments are provided for the panel, and while not absolutely necessary definite indications of the condition of the charge and the maximum voltage relay are a real convenience for the operator.

The operation of the converter is by adjusting it so that the current supplied to the battery is about 50 per cent. more than the usual charging rate. As the charge is continued the charging current will decrease as the battery voltage rises, and the converter voltage will increase as the current decreases, until the maximum charging voltage is reached. At this point the maximum voltage relay is operated and the charge is stopped. The effect is a tapering charge to the battery. In the event of a full charge the rate of current will need adjustment once or possibly twice during the charging period to bring it within the range for the maximum voltage relay to function. Aside from this no attention is necessary after the machine has been started.

The converter can be used in parallel to develop a sufficient amperage for battery charging in the event that more than one vehicle is to be charged. This system is the vogue in a number of garages, an illustration showing an installation in the station of the Fleishman Company at Washington, D. C., where two converters are operated on a 220-volt single-phase circuit and deliver direct current at 70 amperes and with a voltage range of from 65 to 150 volts with a transformer. The switches of a six-circuit switchboard are so arranged that all six vehicles or two groups of three may be charged at one voltage. With six rheostats the rate of charge to every battery can be controlled to meet the condition of the different batteries.

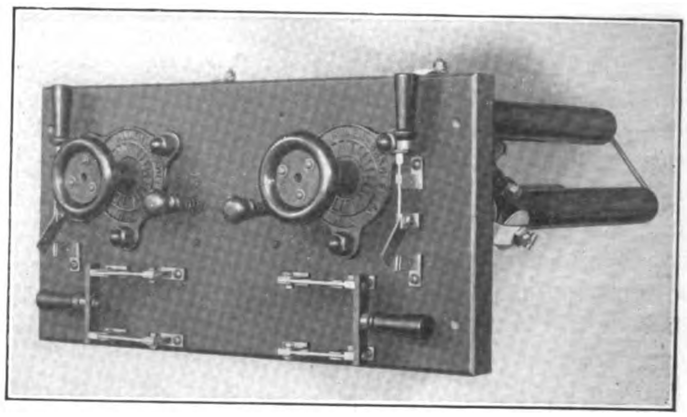


Battery Charging Rheostat for Switchboard Mounting, Type CS-2; Capacity 1000 Watts.



Battery Charging Rheostat for Wall Mounting, Type CW-2; Capacity 1000 Watts.

Claim is made for these converters that with no load the power-factor is about 60 per cent. and at full load about unity. The leading power factor serves to correct the usual low power factor loads on alternating lines, thus increasing the capacity of the lines and transforming and generating apparatus. The Wagner converters are built to endure hard service, with liberal phosphor bronze bearings, and the single-piece end plate construction is followed to afford maximum strength and preserve the alignment of the bearings.



Unit Rheostat Panel Complete, with Necessary Switches, Voltmeter, Push Buttons and Two Charging Rheostats.

The rating is liberal, so that large overloads may be carried momentarily without overheating, and because of this rating the converter will carry a full load continuously with a temperature rise of several degrees than is usually recommended. Besides the service as a converter, the machine may be operated as a motor when desired, thus having a utility that does not obtain in other forms of charging apparatus.

With relation to charging equipment, the compression rheostats and the types of switchboards produced by the Allen-Bradley Company have qualities that are peculiar, and they are protected by patent rights that are controlled exclusively by this concern. The com-

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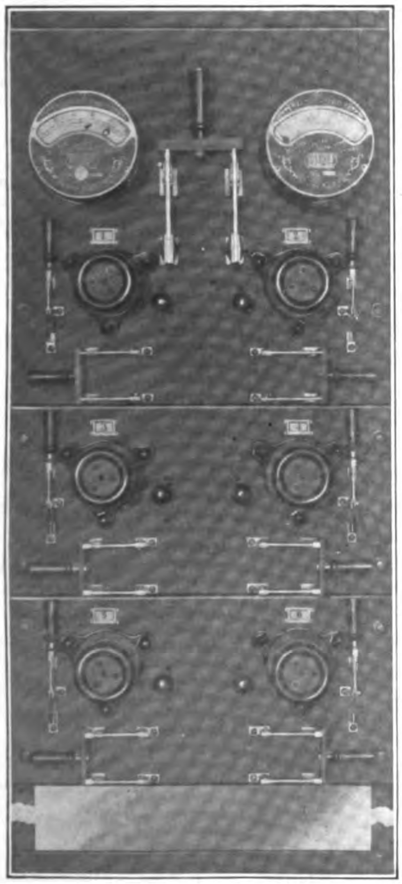
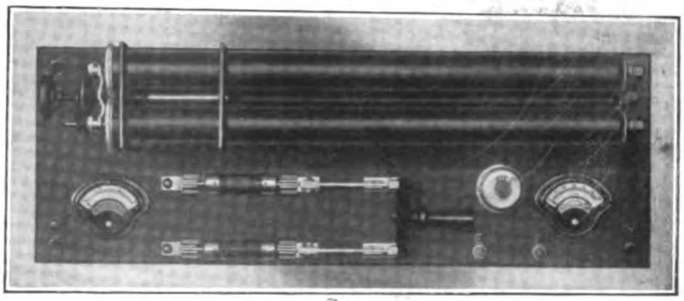
pany is best known as a builder of rheostats for regulation of electric currents, but it has developed switchboards for the utilization of the devices it makes, so that persons who desire can secure the charging panels that are specially adapted for these rheostats.

A rheostat as applied to electrical control is a resistance located in a line. The purpose for which it is used may vary decidedly. Usually resistances for light currents are made of iron or German silver wire, but for heavy currents they are generally cast iron grids. When installed in a line they have a number of taps connected to contact points and an arm extends over these that may be moved so as to vary the degree of resistance. With this type of resistance the design is such that the maximum current flow will fix the cross section of the resistance material, while the maximum voltage drop necessary with minimum current will determine the amount of the resistance. When the reduction of the line voltage through a resistance is considerable, the energy in excess of the charging requirement is dissipated in the form of heat. For this reason rheostats of the cast grid type are usually ventilated to afford radiation, because where the voltage is large or the reduction is necessarily material, the resistance grids will be heated. Exposure to the open air is imperative, and protection is equally necessary to prevent accident or damage from contacts with the grids.



Allen-Bradley Battery Charging Switchboard, Showing Instrument Panel and Two Rheostat Panels—This Can Be Increased to a 10-Circuit Board.

The design of the resistance grid, with the connections from different points to contacts, means that the resistance can only be regulated by steps, and the number of contacts and the voltage drop by steps is dependent upon the uses made of the resistance. To illustrate, with a line voltage of 110 there may be as many steps as the exactness of control requires, the locations being determined by formula. But obviously regulation can be only what the design and construction will permit, and it cannot be by single volts, for instance. Heat is, of course, only dissipated from that portion of the grid in which the current is flowing.

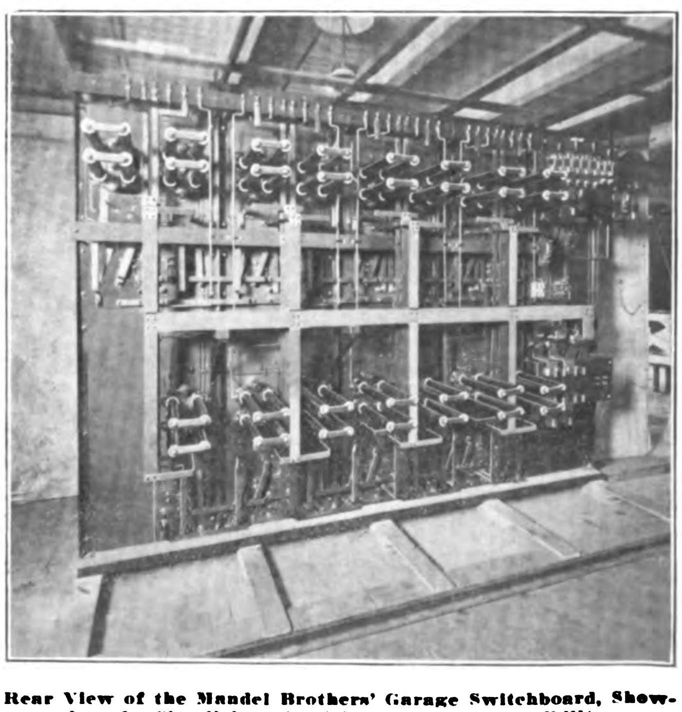


Allen-Bradley Battery Charging Switchboard for Private Garage Service.

Thus the resistances may be divided into varying steps, and as the resistance is cut out the radiation area is reduced.

The Allen-Bradley rheostat consists primarily of a column of carbon discs assembled in a tube, through which the current flows, and the resistance is varied by the pressure applied upon these discs. This means that there is no variation in the radiating surface, this remaining constant, and the resistance from maximum to minimum can be regulated precisely. The statement is made of this type of resister that it was developed because of the possibility of absolutely smooth and even variation of current, especially with reference to motor speed, without the flashing or burning. Not only this, there is extreme durability and simplicity of construction.

The Allen-Bradley rheostat unit is built of a number of prepared graphite discs, the length and diameter of the column and the thickness of the discs varying according to the purpose for which the apparatus is intended. These resister discs have a high contact and a low internal resistance, will not crush or break, are absolutely unaffected by any temperature they may be required to endure, cannot be fused, will not weld or stick together and are not influenced by moisture, chemicals or time. The claim is made that as the con-



Rear View of the Mandel Brothers' Garage Switchboard, Showing the Simplicity of Wiring and the Accessibility.

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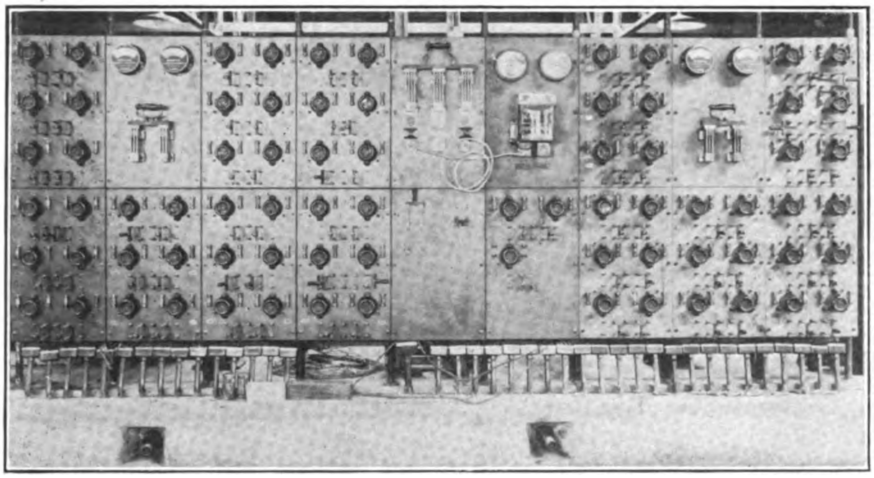
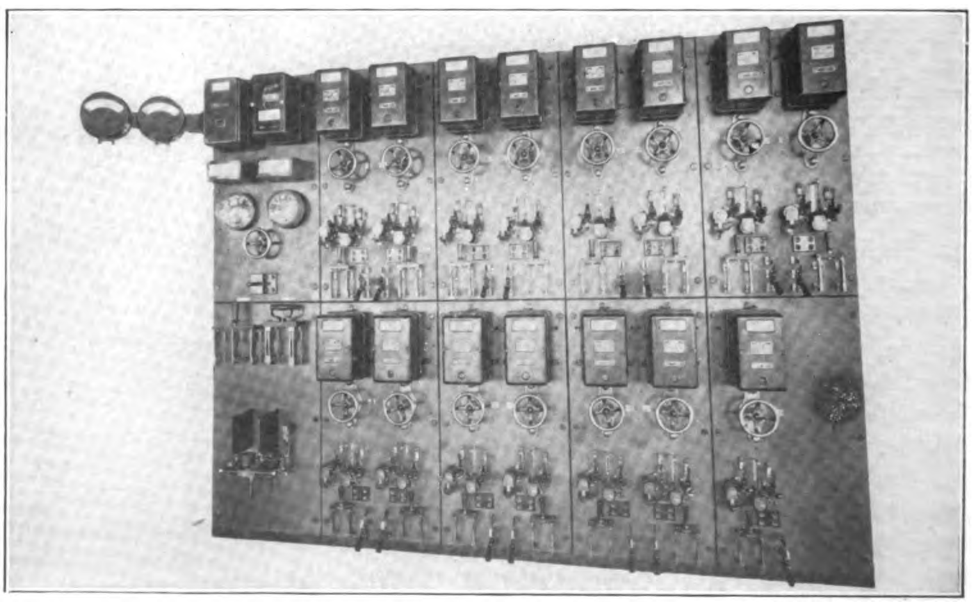


Allen-Bradley Switchboard in the Fashion Garage, Chicago, a Remarkably Compact Construction with 75 Charging Circuits.

tact resistance between the discs composing the resistance column is subject to variations by pressure, there is proportionate resistance changes in the column as a whole. In the complete assembly the resister column is enclosed in a drawn steel tube which is lined for the purpose of insulation with a highly refractory cement, which affords the resister both mechanical and electrical protection, excluding the air, which effectually prevents any combustion should the column be so heated as to be red. When considered desirable the tubes are ribbed to increase the radiating area and the better dissipate acquired heat.

The ends of the steel tubes are closed by caps through which are extended the electrodes by which connection is made between the columns of discs and the external conductors. The mechanism of the rheostats are so constructed that the pressure upon the register columns of discs is varied by exerting force upon one of the electrodes, which is slidable through an end cap, this changing the resistance, without varying the radiation area. The insulating parts are all made of porcelain, mica and molded asbestos. These rheostat units are designed for many purposes, but for battery charging they are built in two types, the one for installations having a switchboard on which are mounted all instruments, switches and rheostats for controlling the different circuits, and the other for mounting on the wall of the charging station, the measurements being taken with the instruments with which the vehicles are equipped.

These rheostats are operated by turning hand wheels that are so fitted that they apply the pressure very delicately, the statement being made that the range through which the resistance may be changed is about the same ratio as one is to 100. Any number of cells, from one up to the maximum practical with the voltage of the supply circuit, may be charged with a single rheostat. The current may be set at any exact value, regardless of the number of cells being charged, and it may be raised or lowered gradually, affording precise regulation and control. The units are substantially built and require but little space, and they may be mounted on the back of a switchboard so that only the hand wheel for regulation is shown on the front. They may be mounted on the switchboard without interfering with the wiring or the installation of the switches and instruments. These rheostats are, for battery charging, installed on switchboards that are made up of a number of units, so that as needs require expansion can be made at minimum expense. Two different standards sizes are built, the one of 60 and the other of 100 amperes capacity. A unit rheostat charging panel consists of two battery charging rheostats and the necessary switches, fuses and the screws for securing the slate panel to the wrought iron frame. A standard switchboard is made up of four of these units, and an instrument panel. The instrument panel includes the main line switch, a voltmeter and ammeter, two battery charging rheostats, the main distributing fuse panel, the wrought iron frame and floor supports and the necessary switches, conductors, etc. In developing installations the instrument panel may be purchased first, which will afford two charging circuits, in connection with which instruments are necessary, and when demands are in excess of the capacity of this, other units, each of two circuits capacity, can be added until a full panel of 10 circuits is constructed.



Allen-Bradley Switchboard in the Garage of Mandel Brothers, Chicago, Ill., Each Circuit Being Equipped with an Underload and Overload Circuit Breaker and a Watt Meter.

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In a similar manner addition panels can be purchased and erected, the original instrument panel serving for indications for the switchboard until a maximum of 30 circuits has been reached, but as the main line switch is mounted on the original instrument panel, and it is the main distributing fuse panel, it is necessary to add instrument panels, but without the instruments, until the maximum number of circuits has been served from the panel first installed. Main line fuses are not included in the standard switchboard equipment, as these should be installed at the beginning of the supply feeder, when the power is obtained from a central station, or on the generator panel, when it is supplied from a private source.

The electric supply feeder cables are connected directly to the clips of the main line switch on the instrument panel. When the switch is open the entire board is electrically dead, with the exception of the two top clips, and the board can be safely left with this switch open. The hinge clips of this switch lead to the distributing bus-bar at the back of the board, from which the several rheostat circuits branch off through fuses to the double-throw knife switches that control the charging circuits. If desired, one or more circuits can be so arranged that batteries can be discharged as well as charged, in which event an additional fixed resistance is provided to take the extra load thrown on the rheostat. The leads from the charging plugs connect to terminals located conveniently at the back of the board.

The above construction conforms to the requirements of the insurance codes, because everything on the front of the board is protected by comparatively light fuses, and little damage would result were a short circuit to happen. The connections taking the ammeter readings are made by bent blade switches, which divert the current in the circuit being measured through the ammeter shunt without interrupting the circuit. The ammeter shunt is protected by a fuse located on the instrument panel, so that its capacity cannot be exceeded in case readings are taken on several circuits at once. The voltmeter connections are made by special double-pole fused push buttons, so wired that the voltage of a battery connected to the charging plug can be read before the charge is started. The push button is an improvement over the plug method, as it is always in readiness, and there need be no delay.

For garages where but a single car or truck is maintained a special type of switchboard is constructed, which consists of a slate panel on which a switch and fuses, voltmeter and charging rheostat are installed. If instruments are included in the equipment of the vehicle these are not needed on the board. These panels are made in different sizes to meet the requirements with lead and Edison storage batteries, and they are sometimes equipped with an automatic switch that will cut out the battery when fully charged, when used in connection with an ampere meter. Relays are provided when specified, to operate in connection with the automatic switch to give overload or underload protection.

An advantage claimed for the Allen-Bradley charging equipment, aside from the qualities afforded through design and construction, is the extremely small space required for an installation of large proportions, and attention is directed to the several illustrations of switchboards that are included in this consideration. One of these is in the garage of Mandel Brothers, a well known Chicago, Ill., department store, and views of both the front and the back are shown, so that the simplicity of construction and the ease of operation are clear to those versed in electric engineering. The other is that of a switchboard in the Fashion garage in Chicago, which has 75 charging circuits, and the compactness of design and the accessibility of the board is a quality that attracts and interests.

(To Be Continued.)

MOTOR TRUCKS AT BROOKLYN SHOW.

Commercial vehicles made a conspicuous department of the Brooklyn automobile show, held in the Twenty-third Regiment Armory, Brooklyn, N. Y., March 2-9, under the auspices of the Brooklyn Motor Vehicle Dealers' Association. This was a boon to Greater New York business men, who were stated to have been disappointed that no commercial vehicles were exhibited at the recent New York show. The increased interest in motor trucks that is now evident throughout the country is said to be largely due to the excellent service they are giving the nations at war in Europe, where they stand up under the severest of tests.

TAX ON SOLID TIRED MOTOR VEHICLES.

A bill designed to place a tax on motor vehicles fitted with solid tires has been introduced into the Massachusetts Legislature by Senator E. S. Birdsall. It is proposed to place a tax, in addition to the regular horsepower tax, amounting to $5 for vehicles of less than 4000 pounds capacity; $10 for those having from 4000 to 6000 pounds capacity, and $15 for solid tired motor propelled vehicles having a carrying capacity of more than 6000 pounds.

TAX INCREASE FOR MOTOR TRUCKS.

A bill which practically doubles the tax rate upon motor trucks has been introduced into the New York Legislature by Senator Hewitt. Among the provisions is one that would add $10 extra to the regular registration fee for commercial motor trucks weighing over 4000 pounds. Another provides an extra assessment for 'buses at the rate of $5 for each passenger seat and $25 for each ton of baggage or freight carrying capacity.

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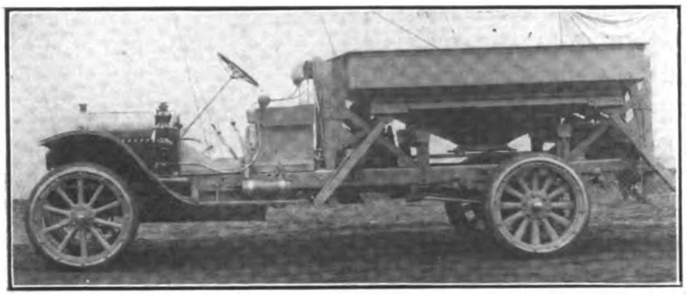
WHITE QUICK-DISCHARGE TRUCK BODY.

UNLOADING economy has been obtained to a very satisfactory degree in a new type of hopper-bottom elevating body developed by the White Company for use on 3000-pound truck chassis for retail coal delivery. Coal dealers maintain that because



White 3000-Pound Chassis Equipped with an Elevating Hopper-Bottom, Gravity-Discharging Steel Body.

the load value is small and the margin of profit extremely limited, motor trucks cannot be used for short haul delivery more economically than animal drawn wagons, one of the principal factors being the time required for unloading.

Admittedly coal cannot always be handled advantageously, for often the crews are required to carry a load up one or more flights of stairs, to side and rear entrances and into cellars, and in other instances the delivery may be made into sidewalk manholes, into bins and pits through chutes, basement windows and where the usual forms of gravity discharging bodies cannot be used.

There are many conditions in which delivery can be made from quick discharge bodies, and it was to meet the requirements of this class of service that the White body was designed, it being determined after a series of exhaustive tests to ascertain its practicality as permanent equipment.

The body is elevated by worm operated lever arms and it can be raised to a height that will insure complete discharge in a brief time. This design is said to be one of the first successful applications of the power hoist to the fast moving medium duty coal truck. The body is intended to afford rapid discharge of the load into manholes, chutes, basement windows, etc., in congested sections of cities where the coal bins are not accessible to other forms of machines.

Statement is made that the body can be elevated in 30 seconds. It is a steel construction and has capacity of 72 cubic feet. It is raised by four lever arms, two at each end, which are attached to transverse shafts that are turned by worms and gears. The worms are driven by sprockets and chains from a longitudinal shaft that is driven from the power transmission gearset of the truck. As the body is raised or lowered, its vertical stability is maintained by four standards that move vertically through four guides mounted upon, and braced from, the frame of the truck.

The truck can be driven to the nearest point to the place where the load is to be discharged, the body elevated and the telescopic chute extended from the base of the hopper to the manhole from either side, and by opening a gate in the hopper the load is carried down by gravity. With any size of coal the body will operate satisfactorily. The discharge can be regulated by the bottom gate. With this equipment delivery can be made in practically any condition without violating ordinances concerning street obstruction.

PACKARD TRUCK GOVERNOR.

The governor of the Packard worm driven motor trucks is a centrifugal type that is automatic in its operation and actuates a valve in the fuel intake between the carburetor and the manifold. It can be set at a predetermined maximum, the speed allowance depending upon the size of the chassis. The entire mechanism is enclosed and sealed. A lever on the central control board operates the automatically controlled throttle within the range that has been determined by the owner. The fan that promotes radiation is mounted on a bracket on the engine case ahead of the cylinder block and is driven by a flat belt from a pulley on an extension of the magneto shaft. In the description of the Packard chassis in the February issue these facts were not clearly stated, and this statement is made that there shall be no confusion arising from the detail given.

NEW LAWS FOR OHIO CHAUFFEURS.

A bill, known as the Bauer bill, distinguishing taxicab drivers from chauffeurs driving for private owners, and placing the former under a more exacting examination than the lattera, was passed by the Ohio Senate recently. The bill further provides that the minimum age of drivers of motor vehicles shall be 16 years. An attempt to fix the maximum age at 60 was made, but not provided for in the new law.

The White Hopper-Bottom, Gravity-Discharging Body Elevated, with the Discharge Chute in Position.

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REGULATING MOTOR VEHICLE SPEED.

Pierce Model G Controller That Operates When a Definite Limit Is Reached, and the Motor Governor, Which Prevents the Engine Being Raced.

REGULATION of vehicle speed is regarded as absolutely necessary by those who have studied the use of motor wagons and trucks. This necessity is realized as more imperative each day. There are many reasons for this need. Because of constant increase of traffic dangers in the streets the public demands that machines be so limited as to speed that they can be positively controlled. There is a very general belief existing that driven rapidly trucks and wagons are especially destructive of even well paved streets.

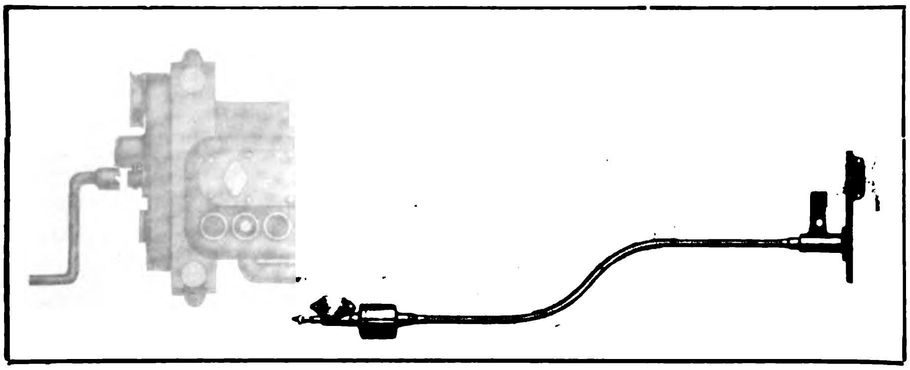

Fig. 1—The Pierce Model G Controller as Installed for Driving from the Main Power Shaft.

The buyers of motor wagons and trucks require that there be sufficient power to haul capacity loads in sandy, muddy, rutted or rough roadways, on steep grades, and in snow of varying depth, and this means a considerable excess of the requirements in operating conditions that are regarded as normal. With reference to grades, practically a third of the mileage driven is ascending grade, and with any surface condition that lessens traction the power necessary for hauling on gradients is several times what would be needed on levels or descents.

Good engineering and economical reasons dictate that a vehicle motor be operated at as near constant speed as can be maintained. That is, that no matter what ratio of the power transmission gearset is in use the motor should turn approximately the same number of revolutions. Following this practise the speed of the vehicle should vary precisely with the ratios of the gearset. The average driver will work his engine at high speed until he is forced to use the intermediate ratio, and will then accelerate the motor much faster than is necessary to climb a grade and move through sand or mud. If traction in any way fails, and the low ratio is used the engine is still harder worked to drive the machine as fast as possible.

Each change of driving shaft speed, which is made through shifting gears, means greater leverage, or the slower application of power, but instead of maintaining the engine at a standard number of revolutions, it is generally raced, which means unnecessary consumption of fuel and lubricant, excessive wear through greater stresses, and no useful purpose is served.

Driving a vehicle fast when light is even more damaging than racing the engine when loaded. The average wagon or truck springs, unless loaded, will not absorb the road shocks, because they are not sufficiently resilient, and are really destructive because they communicate every shock and vibration with full force to the entire mechanism. As drivers cannot be depended to so drive vehicles as to minimize the effects of road shocks, the only protection the owners can secure is by regulating the engines to predetermined numbers of revolutions. In steam engine practise the governing is by a device that will diminish or increase the supply of steam from the boiler, as the number of revolutions are varied from the standard number set for the normal work. The engine is driven as near a constant speed as possible. If the load is varied more or less steam is supplied, as may be needed, but only what is required to do the work. No good result would be obtained by developing power that is not necessary or is wasted because it cannot be utilized.

The principles of governing applied in steam engines have been developed in the devices perfected by the Pierce Speed Controller Company, Anderson, Ind., in that the supply of fuel is regulated when a maxi-

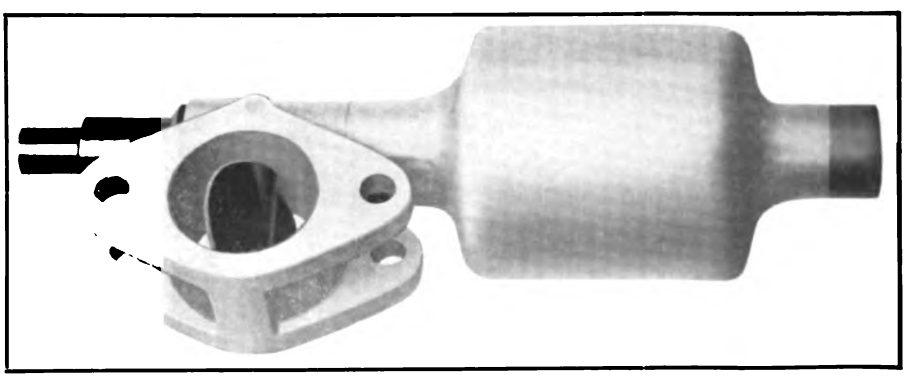

Fig. 2—Pierce Model G Controller, Showing the Valve Box and the Butterfly That Regulates the Fuel Supply.

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mum number of revolutions are made by a vehicle motor. This company has specialized gasoline engine regulation and it now is producing two different types, the one of which is known as the Pierce governor, and the other as the Pierce speed controller. These instruments have been proven in every operating condition in which motor trucks and wagons have been practically used, and in no instance have they been inefficient or unsatisfactory.

The most recent production is the model G controller, which is illustrated at Fig. 1. This differs from any other engine governing device in that it is actually controlled by the speed of the machine. In the illustration the controller is fitted to a unit power plant, and the driving end of the assembly is fixed in a bracket that carries a gear that is meshed with a pinion on the main shaft of the power transmission system, directly in the rear of the gearset case. The controller bracket is bolted to the gearset case. From

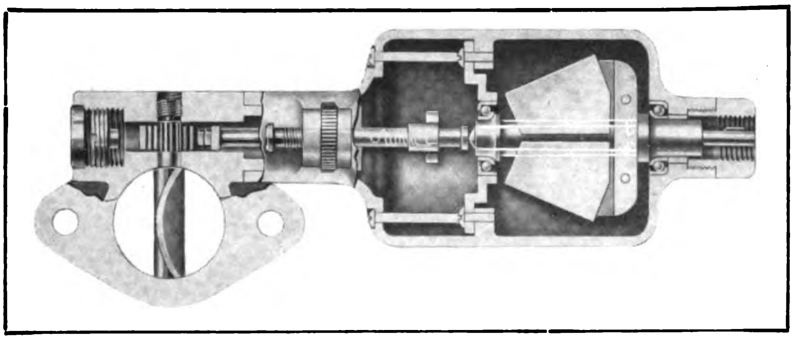

Fig. 4—Sectional View of the Pierce Motor Governor, Which Is Operated by the Movement of the Weights on the Shaft.

this bracket a flexible shaft in a case extends among the power plant and the forward end is coupled to the controller, which is mounted on the fuel intake manifold above the carburetor. The illustration is of the top of the engine, and the controller shaft is along the side, at a height where it is not an obstruction for work or attention.

As will be noted from Fig. 2, which shows the controller, this is bolted between the carburetor and the intake, where it is firmly secured and cannot be removed. The control of the engine is really the movement of the vehicle, for the main driving shaft must make a specific number of turns for each complete revolution of the traction wheels. The number of revolutions of the engine may be varied greatly, but when the movement of the vehicle reaches the speed for which the controller is adjusted, the butterfly valve in the controller, which is normally in a position that does not obstruct the flow of gas, is swung so as to reduce the valve port area, and the volume of fuel that the en-

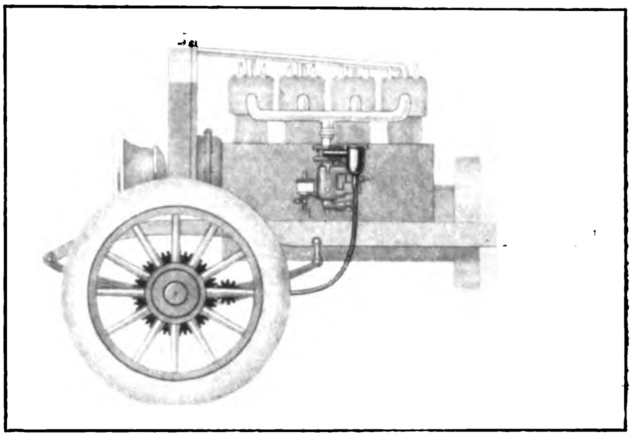

Fig. 5—Pierce Speed Controller, Driven from a Front Wheel and Regulating Vehicle to a Maximum Pace.

gine draws is lessened. The valve is actuated by what is an adaptation of the ball governor principle. On the controller shaft are two weights that are pivoted so that as the velocity of the shaft is increased they are swung outward, forcing a sleeve forward that moves a slidable shaft that moves the butterfly of the valve. The sleeve and shaft are forced against a spring calibrated to a standard of pressure, so that as the speed of the shaft is lessened the weights are returned to the normal position. The operation is exceedingly simple, the action is positive, the adjustment can be made very fine, and there is no probability of wear. The controller is encased and cannot be affected because the housing is dust and water tight, and when once lubricated requires no attention for a long period of time. This controller is adjustable at the small end, and it is sealed so that it cannot be tampered with

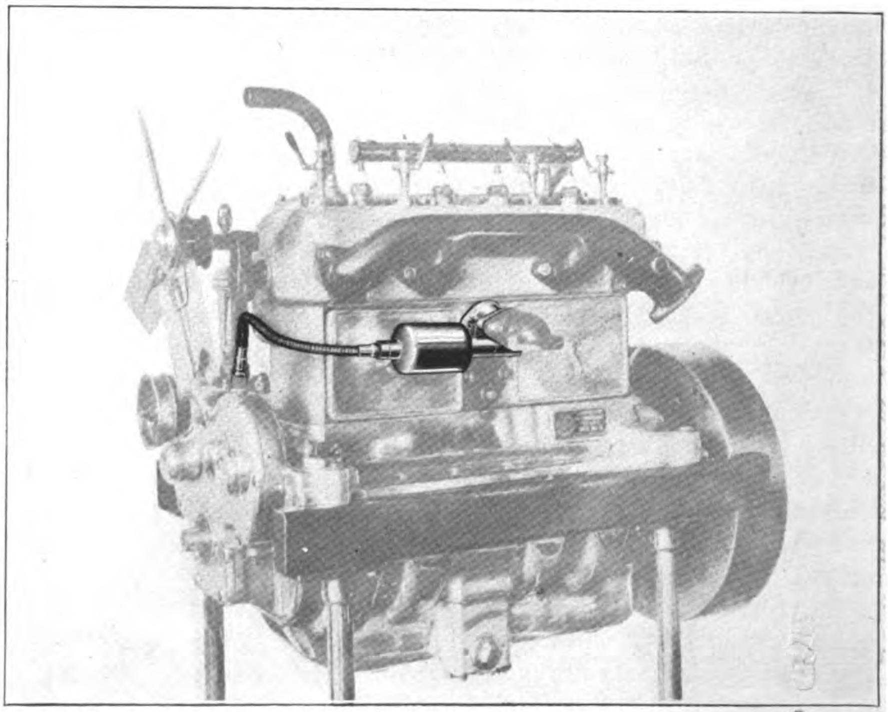

Fig. 3—Pierce Centrifugal Motor Governor as Installed on the Engine to Drive from the Camshaft.

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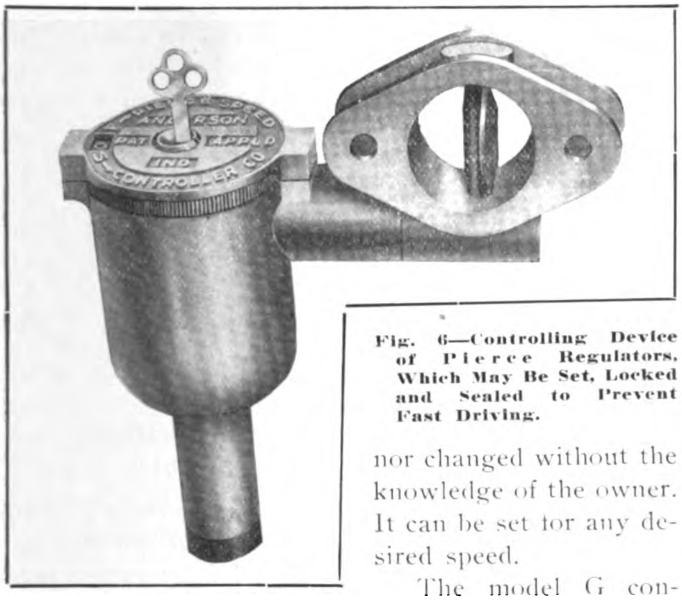


Fig. 6—Controlling Device of Pierce Regulators, Which May Be Set, Locked and Sealed to Prevent Fast Driving.

nor changed without the knowledge of the owner. It can be set for any desired speed.

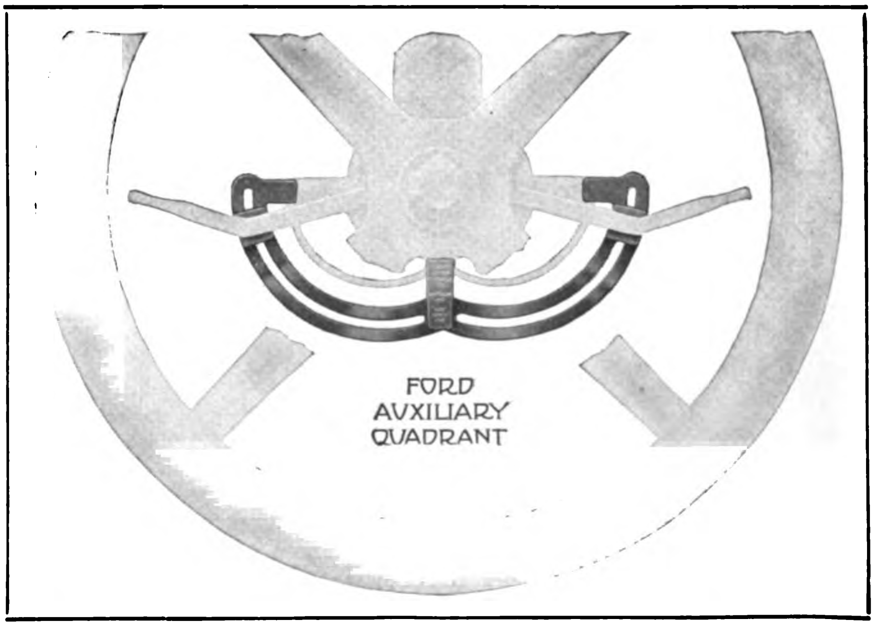
The model G controller is especially adaptable for use on taxicabs, trucks, fire apparatus, patrol wagons, ambulances and vehicles where there is need of controlling the speed of the machine and not the motor, and it is stated to be extremely efficient. This type has been produced but a short time and is regarded as an improvement of the model T controller, which is driven from the front wheel, in that this equipment is not subjected to the wear that resulted from attachment of the driving mechanism to the front wheel, where it is exposed to road shocks and other stresses. The model G is now used extensively by truck manufacturers and operators of taxicab services.

Fig. 3 illustrates the Pierce centrifugal motor governor, an instrument that weighs but nine ounces and which is very strongly constructed and long enduring. This governor is said to be recommended and is used by all motor manufacturers using governors. The principle of operation is practically what has been described, an adaptation of the ball governor, in which centrifugal force controls the action of the valve in the intake manifold. This governor is distinctive in that it is designed to positively regulate the number of revolutions of an engine, and it may be set to be operative at any speed desired. It differs from the model G controller in that it is independent of the speed of the road wheels and acts upon the engine when the predetermined number of revolutions a minute is reached. The installation in the fuel manifold is practically the same, but it is driven usually from the camshaft, which is designed to be driven at half motor speed. This action of the governor is dual in that it not only limits the speed of the vehicle, but prevents racing the engine. Fig. 4 shows this instrument installed to be operated from an engine camshaft.

The Pierce speed controller is illustrated at Fig. 5, this instrument operating practically in the manner that has been described, and it is particularly adaptable for trucks and vehicles that are already in service. The controller may be installed in about three hours. This is driven from the front wheel, as is the ordinary speedometer, and this will regulate the speed of the machine, as it will not operate until the vehicle is moving at a speed within a mile an hour of the standard for which it is adjusted. Fig. 6 illustrates the controller proper, with the butterfly valve, such as is used with all Pierce speed controlling devices.

This type of controller has a dial that is graduated to miles an hour, and these graduations are begun at zero. They are visible through a small hole in the controller cover. By revolving a knurled dial the speed of the vehicle may be set to any desired standard with a maximum of 25 miles an hour. After the controller has been set it is locked with a key, the keyhole is covered and the cover is sealed. The driving connection with the front wheel is also sealed, and after it is installed and adjusted the speed of the controller cannot be changed save when the seals have been broken, for the cover must be moved to insert the key. This controller is used by many taxicab operators and fire patrol companies. It may be locked so that a vehicle cannot be started by any other than the person having the key.

All of the Pierce instruments are sealed, so that changes cannot be made without knowledge of the owner or his representative. The controllers and governors are so constructed that they cannot fail unless broken by accident, they are very carefully constructed and are calibrated to a standard of accuracy that has been carefully determined. Each is thoroughly tested before being passed to the sales department, and is guaranteed for a year (aside from the flexible driving shaft), the company to replace defective parts without charge if the instruments are returned with



Quadrant with Friction Levers for Ford Cars to Secure Fine Adjustment of the Ignition System and the Fuel Supply.

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the seals unbroken.

The controllers and governors can be easily installed without loss of time of the vehicles, and the valve boxes (in which the butterfly valves are placed) are made in sizes and shapes to fit all standard types of intake manifolds, which may be specified in ordering. Pierce governors are stated by the company to be standard equipment with the Continental Motor Manufacturing Company, to be recommended by the builders of Rutenber, Buda, Wisconsin and the Hirshell-Spillman motors, and are used by more than 100 manufacturers of motor vehicles.

The company manufactures a quadrant with two friction retained levers for replacing the notched quadrant and levers for controlling the ignition system and the fuel supply of Ford cars. This makes possible unlimited adjustment and precise regulation, and it cannot be affected by wear. The quadrant can be attached by any owner, as this is done by tightening a simple set screw. The device is interchangeable and it is sold at a very moderate price. The company is also producing a bell signal for trucks and pleasure cars that is extremely serviceable and can be easily attached.

MOTOR 'BUSES AND FRANCHISES.

That operators of motor 'buses are to meet with strong opposition is evident from the bill introduced into the Massachusetts Legislature requiring operators of those motor vehicles to obtain franchises before engaging in business. Similar legislation is likely to be suggested in many other states in the near future.

The matter of motor 'buses has been discussed in New York City before the mayor and the franchise committee of the board of estimate, and then was disclosed active opposition on the part of the Third Avenue railway, representatives claiming that the city owed too much to its railways to permit their business to be injured by "unfair competition".

The development of the motor 'bus business presents many problems in large cities. In already congested streets the larger 'buses interfere seriously with miscellaneous traffic, and it is charged therefore that they should be regulated as are the surface railway cars. Another charge is that some of the operators are without financial backing and in case of damage suits and the like it would probably be impossible to recover. Chicago is quoted as an illustration of the present importance of the motor 'bus, as in that city a provision has been made in the annual budget for $3,000,000 for motor 'buses, and $2,000,000 for subways.

WAR HOLDS UP BALL BEARINGS.

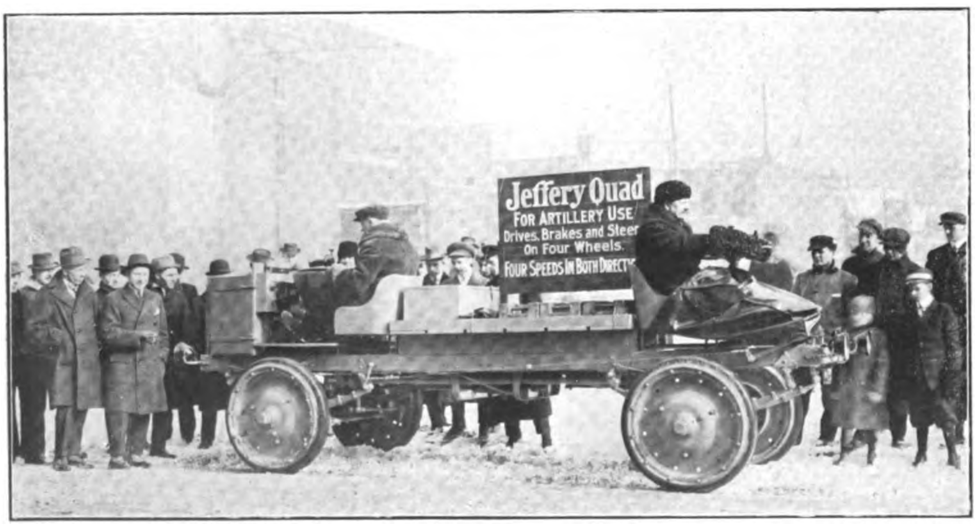
Under the recent decision of the German government in relation to its war embargo, all ball bearings and parts are absolutely prohibited from export from that country. The ball bearing interests in New York City are optimistic, however, stating their belief that the embargo is only temporary, and that concerns in this country have large stocks on hand that are sufficient to supply the demand until the embargo is lifted.

NEW MOTOR COMPANY IN INDIA.

The India General Motors Company, Calcutta, India, has been formed with a capitalization of 200,000 rupees, to establish motor services for the transport of passengers and goods.

TRUCK EXPORTS GREATLY INCREASED.

The value of motor trucks exported in December, 1914, from the United States was 33 times greater than in the same month of 1913, and was more than double the value for the whole year of 1913, according to the figures submitted to the National Automobile Chamber of Commerce by the United States Department of Commerce. The figures for last December are: 1279 commercial automobiles, valued at $3,387,729, as against 88, valued at $100,660, exported in December, 1913, and 1009, valued at $1,686,807, exported during the year 1913. Figures for passenger cars for December last were stated to be 1297, valued at $998,698, making the total motor vehicle exports for the month 2576, with a total value of $4,386,427, as compared with 2389, worth $2,152,144 in 1913, and 2013, valued at $2,060,812 in 1912. The exports thus far have been very large.



Jeffery "Quad" Chassis with Driving Control at Either End, Having Four Forward and Reverse Speeds, Designed for United States Army Service.

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S. A. E. 1915 STANDARDS COMMITTEES.

The programme of activities of the Standards Committee of the Society of Automobile Engineers for 1915 was suggested at the meeting of the council when the membership of the several divisions was reorganized, as has been the custom annually. K. W. Zimmerschied, past vice president of the society, was appointed chairman. Besides appointing a new personnel, two new divisions, the International Standards and the Chain divisions, were inaugurated. The following five divisions were suspended temporarily: Aluminum and Copper Alloys, Broaches, Data Sheet, Motor Testing and Standards Exchange, while the Commercial Car Wheels division was combined with the Truck Standards.

The work of the Data Sheet division, it is stated, will be continued at the society's office in conjunction with members especially well informed on the various subjects under that division. The Miscellaneous division will carry on the unfinished work of the Standards Exchange division, while the other divisions were suspended because it was felt that their work had been accomplished, for the present at least.

The new International Standards Division is designed to broaden the scope of activities of the society by carrying its work into foreign countries to assist and formulate the standardization of the design and construction of motor vehicles. The standardization of pneumatic and solid tires, particularly the latter, of American and European manufacture, will receive much attention. It has been frequently pointed out that the subject of interchangeability of solid tires on American and European rim standards has become acute. To better overcome the many difficulties expected, and to gather the widely distributed data, the membership of the International Standards division is made up of members of the society residing in a number of countries.

The Chain division, the formation of which was suggested and approved at the last meeting of the Standards Committee, is to endeavor to create a standard tooth form for silent chains.

Division Membership for 1915.

The members appointed to the several divisions for 1915 are given as follows:

Ball and Roller Bearings division: F. G. Hughes, chairman; C. H. Clement, David Fergusson, F. M. Germane, B. D. Gray, F. J. Jarosch, C. W. McKinley, W. R. Strickland and M. W. H. Wilson.

Carburetor Fittings division: Jerome J. Aull, chairman; Arthur B. Browne, C. W. Findeisen, C. P. Grimes, George M. Holley, Howard Marmon, C. W. Stiger.

Chain division: Warren J. Belcher, John R. Cautley, Herbert F. Funke, F. W. Morse, H. Schipper Pierce, Wm. A. Rockenfield.

Electrical Equipment division: A. L. Riker, chairman; Joseph Bijur, W. L. Bliss, C. M. Bunnell, Alexander Churchward, W. H. Conant, H. W. Harper, Russell Huff, Leonard Kebler, T. L. Lee, A. D. T. Libby, Alden L. McMurtry, R. J. Nightingale, H. G. Osburn, William H. Palmer, Jr.

Electric Vehicle division: A. J. Slade, chairman; J. R. C. Armstrong, H. S. Baldwin, E. P. Chalfant, Alexander Churchward, W. H. Conant, R. S. Fend, Bruce Ford, J. H. Hertner, W. E. Holland, William P. Kennedy, Robert McA. Lloyd, E. J. Ross, Jr., C. A. Ward, G. W. Wesley, F. A. Whitten, E. R. Whitney.

Frame Sections division: J. G. Perrin, chairman; C. E. Clemens, J. E. Maloney, A. L. Riker, L. R. Smith, W. R. Strickland.

International Standards division: W. H. Allen, C. C. Carlton, A. Ludlow Clayden, J. E. Hale, H. M. Leland, B. Maraini, John V. Pugh, A. A. Remington, C. B. Whittelsey.

Iron and Steel division: K. W. Zimmerschied, chairman; G. F. Fuller, Radclyffe Furness, J. A. Mathews, George L. Norris, J. H. Parker, C. F. W. Rys, G. W. Sargent, Henry Souther, F. W. Trabold.

Lock Washer division: C. H. Loutrel, chairman; C. E. Davis, C. W. McKinley.

Miscellaneous division: John G. Utz, chairman; E. H. Ehrman, Berne Nadall, N. B. Pope, C. W. Spicer, E. E. Sweet, E. R. Whitney.

Pleasure Car Wheels division: E. R. Hall, chairman; H. L. Barton, C. E. Bonnett, R. S. Bryant, C. C. Carlton, J. G. Vincent, J. H. Wagenhorst, C. B. Whittelsey, C. B. Williams.

Research division: David L. Gallup, chairman; R. M. Anderson, R. C. Carpenter, H. L. Connell, Walter T. Fishleigh, F. R. Hutton, Charles E. Lucke, J. A. Moyer, Daniel Roesch, C. B. Veal.

Springs division: C. W. McKinley, chairman; A. C. Bergmann, C. E. Clemens, Ralph L. Morgan, W. M. Newkirk, C. F. W. Rys.

Truck Standards division: William P. Kennedy, chairman; W. H. Allen, B. B. Bachman, George D. Carpenter, H. D. Church, C. F. Clemens, J. E. Hale, Russell Hoopes, Robert McA. Lloyd, C. T. Myers, F. F. Phillips, A. C. Schulz, E. R. Whitney, C. B. Whittelsey, John Younger.

Date Set for Midsummer Meeting

A large number of the members of the society is expected to attend the summer meeting, which is to be held on board the steamship Noronic, the spacious flagship of the Northern Navigation Company, sailing from Detroit, Mich., on the afternoon of June 14, for a cruise in and about Georgian bay, returning to Detroit on the afternoon of Thursday, June 17. It is planned to hold five technical sessions during the cruise. Further particulars can be obtained from the New York City office of the society, at No. 1790 Broadway.

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TRACTORS FOR NAVY YARD.

Electric Machines of Three-Ton Capacity for Service at Bremerton.

The Waverley Company, Indianapolis, Ind., has just completed an electric tractor and trailer that is for service in the United States navy yard at Bremerton, Puget Sound, Washington, and which is stated to be the first machine of the kind constructed. It is designed for extremely heavy service and is expected to endure for a long period of years.

It does not materially differ in general principle from the design of electric trucks for highway service, but it is built for work that is necessarily slower and will carry loads of at least three tons. The rectangular chassis frame is constructed of structural steel, with longitudinal members to insure rigidity, and at the forward end of the tractor is a structural steel bumper to prevent damage in the event of a head-on contact with an obstacle while moving. The platform is made of riveted sheet steel, and on this is mounted a steel turntable, which is not unlike the base for the monitor turret of an armored machine.

The tractor is fitted with 24-inch cast steel wheels that are shod with solid rubber tires, as it is not intended for use on roads. Most of its service will be in the shops and along the planked ways of the yard. The seat for the driver is offset at the left side of the forward end, this arrangement leaving the entire surface of the platform, 132 by 60 inches, free for freight carrying. The tractor is equipped with a 30-cell, 21-plate lead battery, and it is expected that this will drive it 30 miles on a single charge. The maximum speed of the tractor is about 5½ miles an hour, when on a level surface and drawing the trailer.

The trailer is in general appearance similar to the tractor, but it has not been fitted with a bumper, a motor or a battery. It has the same size turntable, however. The tractor draws the trailer by a steel cable 50 feet length, this making possible the train carrying a metal beam weighing six tons and the greatest length that can be carried on the ordinary flat car. With the ends of the beam resting on the turntables of the tractor and trailer the train can turn corners readily or can be taken from the main runway to the cross aisles of the shops.

Waverley Electric Shop Tractor and Trailer, Three Tons Capacity, Built for the United States Navy Yard at Bremerton, Puget Sound, Washington.

The turntables will be of great convenience in handling metal beams, angles, plates, etc., and the train as delivered is expected to be a large economy. The design is the result of very carefully developed engineering and a knowledge of the requirements for moving heavy materials.

DENBY'S NEW VICE PRESIDENT.

At the annual stockholders' meeting of the Denby Motor Truck Company, Detroit, Mich., Henry Lansdale was elected vice president of the company, coming from the general management of the Krit Motor Car Company, Detroit, of which he previously had been eastern sales manager. Before joining the Krit Company Mr. Lansdale was for five years assistant to the general manager of the Cadillac Motor Car Company, Detroit.

ARMORED MOTOR TRUCKS FOR WAR.

A Jeffrey Quad truck exhibited by the United States government at the Panama-Pacific Exposition is equipped with an armored body and a rapid fire gun for war purposes. It is the only truck of the kind on exhibition by the government, and in essential features is in duplicate of those Jeffrey trucks now in use in the European war. It is attracting considerable attention.

NEW CHASE DISTRICT MANAGERS.

The Chase Motor Truck Company, Syracuse, N. Y., has appointed two new district sales managers. W. S. Dodds, formerly district sales manager of the Maccar Company, with headquarters at Buffalo, N. Y., will have charge of the territory embraced by eastern Ohio, western Pennsylvania, and part of New York state. E. R. Madden, coming from the ranks of the Chase Company, will control the territory around Kansas City, Mo.

MOTOR TRUCKS FOR GREAT BRITAIN.

As a preliminary to an order for 250 motor trucks for war services for Great Britain, the South Bend Motor Car works, South Bend, Ind., constructed two trucks for delivery on Feb. 15. One was to be used for general work in the British army and the other, of smaller measurements, for field ambulance service. A. C. Mechlenburg, owner of the works, stated that he also had received an order from Manitowoc, Wis., for two chemical engines, and another from Gary, Ind., for a police patrol, both orders to be shipped in March.

NEW BRITISH TIRE STANDARDS.

An announcement of considerable importance to manufacturers of tires and rims in the United States is that the tire committee of the British Society of Motor Manufacturers and Traders has decided to reduce the number of standards of pneumatic tire rims from the 23 established last year to 10, and that 11 different sizes will be standardized for tires themselves. The proposed standards are:

Millimeters.	Equivalent in Inches.
*700x 80	27.5x3.14
*700x 85	27.5x3.34
*710x 90	27.9x3.54
760x 90	29.9x3.54
810x 90	31.9x3.54
815x105	32.1x4.13
820x120	32.3x4.72
880x120	34.6x4.72
895x135	35.2x5.31
935x135	36.8x5.31
915x175	36.0x6.88

*These tires fit the same rim.

To meet these standards, which will be effective throughout Europe, it seems apparent that American manufacturers will have to make their tires special to conform to the standards of the S. M. M. and T. specifications. It is obvious that rims on American made cars will not conform to these standards.

A notable feature of the standards is that no provision has been made for tires of larger diameter for use on the rougher roads of the British colonies. The neglect is said to be with the idea of leaving the larger sizes unstandardized at this time.

COLLEGIANS STUDY AUTOMOBILES.

With the mechanical aid of lantern slides, models and equipment, the University of Wisconsin is offering an extension course in the gasoline automobile in a number of Wisconsin towns. Classes are being organized in the leading cities, which will be addressed by Prof. Earle B. Norris, who is in charge of the mechanical engineering work of the extension department of the university. Prof. Norris was at one time experimental engineer for the Reo Motor Car Company, Lansing, Mich., and in planning the course he was assisted by George W. Hobbs, formerly of the Buick Motor Company, Flint, Mich., and the Weston-Mott Axle Company, and by B. G. Elliott, formerly with the McKeen Motor Company. Messrs. Hobb and Elliott are members of the university's engineering staff of the extension department.

RULING EFFECTING COMMERCIAL CARS.

Owners of touring cars and motor runabouts used exclusively for commercial purposes, such as taxicabs, or cars used by salesmen or real estate dealers, in Indianapolis, Ind., must pay an annual license fee equal to that of motor trucks, according to a recent ruling in that city. An Indiana statute prohibits the cities of the state from licensing any except commercial motor vehicles.

GOODRICH FAIR LIST PLAN.

It Insures to Motor Vehicle Owners Prices That Are Standard.

The B. F. Goodrich Company, Akron, O., maker of Goodrich "Safety Tread" tires, has inaugurated a "fair list" price plan which places the selling price of tires on a net basis, instead of selling by discounts. Thousands of tire dealers are stated as having indorsed the plan, and the fact that the plan carries with it a substantial reduction in prices is of much interest to tire users. The plan, it is explained, is not intended as a price-cutting war involving tire manufacturers, but is an effort to protect the consumer from concerns that slash prices on a list "marked up" for that purpose.

An official of the company, in discussing the plan, said: "We are fighting for the rights of the legitimate tire dealers, as well as for the interests of the tire user. The padded price list must go—and with it will go price-cutting, 'haggling', unfair profits due to lists 'marked up' to catch the unwary motorist and last, but not least, the tire user's fear that he is being stung—that there is always some lower price just around the corner, that he ought to seek.

"We are 'fair-listing' our tires everywhere. We have reduced the price somewhat and we have put our price lists on a basis where maker and dealer are satisfied with fair and reasonable profits that leave enough in the price-to-consumers that will insure qualities that will translate themselves into long and satisfactory mileage.

"This bold move is admittedly an attack on unsatisfactory methods of tire retailing that have obtained in some quarters. Methods unsatisfactory to the dealer, because price cutting off of a 'padded' price list, took up expensive time for extra selling effort and left him an average of profit generally lower than obtained from a fair list. Methods unsatisfactory to the motorist because he had to haggle for his tires, shop around and never feel certain that he had actually paid the rock-bottom 'fair' tire price.

"With Goodrich 'fair-listed' tires he now can be sure of just that—he knows he is paying the fair price—that he is buying a standard, high-grade article that has one price the country over, whether he buys in Maine or California, whether he buys in the city store or the road side shop, in a hurry or not, he always pays one price—a fair one—that protects motorist and dealer alike".

WOULD EXEMPT MUNICIPAL MOTORS.

The city solicitor of Pawtucket, R. I., has been authorized by a joint resolution of the Board of Aldermen to appear before the General Assembly to urge the passage of a law exempting the city automobiles from registration fee.

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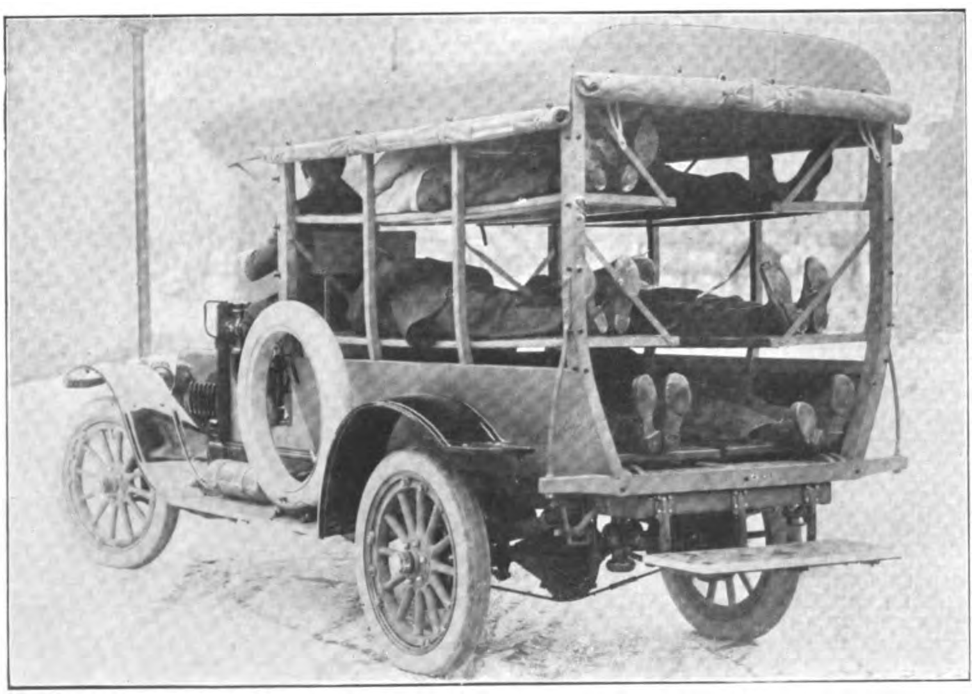
DENATURED ALCOHOL PRODUCTION.

The ways and means committee, which is backing the so-called "denatured alcohol bill" that was recently passed by the House of Representatives of Congress, advises the mixing of wood alcohol with "domestic" alcohol, giving the following precedure in a report:

"The usual apparatus of an ethyl-alcohol distillery is attached to the usual apparatus for the destructive distillation of wood (by means of which ethyl-alcohol is produced) in such a manner that the ethyl-alcohol, before it has passed through the state of vapor, or while in the original closed and continuous process of distillation, is intermingled with the vapors arising from the destructive distillation of wood or other suitable denaturing material or materials, or admixture of the same, thereby producing a distillate which is neither ethyl-alcohol or methol alcohol, although containing both substances, but which is suitable for industrial purposes. Those who have devised this process call the product "distol" and claim that it differs in no essential respects from what is already known as denatured alcohol".

MOTOR TRUCK VERSUS HORSES.

A KisselKar six-ton truck and a six-ton trailer in the service of the Minneapolis Steel and Machinery Company, Minneapolis, has been stated to show a net saving in operating cost over horse service of about $55 a day. At the end of a period of about 10 months it has registered a mileage of more than 9000 miles, carried an average load of approximately 15 tons, and still used its original tires. It required repairs only once, which caused a loss of about 10 hours' time.



A Field Ambulance Designed to Carry Six Wounded Persons on Stretchers, with Side and End Curtains, Built by the Thomas B. Jeffery Company for a 1500-Pound Chassis.

NEW TRUCK WHEEL MANUFACTURER.

The officers of the newly created United States Wheel and Tire Company, Rockton, Wis., are as follows: E. S. Gleasman, president; G. W. Shaw, vice president; N. M. Wilcox, secretary; J. Roy Atwood, treasurer. Frank Denny is the sales manager. The company will manufacture an elastic or flexible wheel for motor trucks and cars, whose main feature is a series of flat elliptical springs so arranged that the tire proper will bear even more severe side stress than the wheel spokes themselves. These wheels will be built, it is said, as soon as the company's brick and concrete factory, 100 by 100 feet, is constructed upon the four-acre site donated to the company.

STOP AUTOS FOR TROLLEY CARS.

To pass a standing trolley car while it is either receiving or discharging passengers, henceforth is to be considered a misdemeanor for motorists in Hartford, Conn., according to a recent ordinance. It is further provided that a motor driver must not pass around the left side of a trolley car in order to get ahead, a practise that has been common in that city heretofore

TRUCK BUILDER'S TRUCK ECONOMY.

A transportation system that can probably be duplicated throughout the country is now operated by the Locomobile Company of America, Bridgeport, Conn., between its factory and New York City. It is said to be economical, as well as to expedite deliveries. In speaking of the innovation, an official of the company said: "We were getting castings from the Isaac Johnson Company at Spuyten Duyvil (N. Y.), which were to be shipped by express to us. Owing to the fact that we were pressed for this material on several occasions we sent testers' cars for a supply of the parts. From the computations of cost kept by the company we found that it was both quicker and less expensive to operate the automobiles and we have continued the service with the possibility that it will be greatly increased in the near future. With fast trucks there is no reason why regular delivery lines between this city and New York should not be profitably established, as expedition in deliveries is a material consideration to many factories in this city". Three trucks and one touring car chassis are in service.

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ADDING MILEAGE TO SOLID TIRES.

A subject of great importance to users of motor truck solid tires was discussed by the head of the service department of the Goodyear Tire and Rubber Company, Akron, O., who said: "Much is said about the care necessary to obtain good service from pneumatic tires; but there isn't much said about the care of solid tires, and as the truck industry develops this becomes a more and more important subject. It is true that compared to pneumatic tires, solids need little care, but what care they do need is absolutely essential to full mileage.

"By far the most important precaution is to see that your tires are not overloaded. And here is the reason. Everybody realizes that rubber, if stretched too far, will break. Very few people realize that rubber if compressed too tightly will break also. That is just what happens when too great a load is imposed on a truck tire. The tire is crushed between two unyielding surfaces, the road and the steel base of the tire. If the load is too great, the compression becomes too much and the molecular structure of the rubber is broken down".

He points out that it requires only one overload to ruin a tire forever. "Take a toy balloon", he added. "Blow it up. It stretches and stretches, but at a certain point it breaks, and after that the balloon is no good. The same is true with a truck tire, only in a different way. Put a solid tire on a truck and load the truck. The tire compresses and compresses up to a certain point and then breaks. Once it is broken it can't be used again with satisfactory results.

"The best tire advice that we can give a truck owner is: 'Equip your truck with tires adequate to carry the load you want to put on them—then give your driver hard and fast instructions that to that point he shall load the truck and no farther'."

MANAGER OF MOTZ COMPANY RETIRES.

The many friends of T. H. McGiehan, vice president and general manager of the Motz Tire and Rubber Company, Akron, O., will be interested to learn that he left that company March 1 to enter the rubber supply business in New Orleans, La., where he will represent several tire and sundries manufacturers.

The Detroit branch of the Goodyear Tire and Rubber Company, Akron, O., is now in charge of W. A. Hazlett, formerly manager of the company's Pittsburg, Penn., branch. He succeeds C. W. Holcker, who has been promoted to assistant district manager.

At a recent meeting of the Detroit section of the S. A. E., E. L. Osborne, of that city, read a treatise entitled "Motor Truck and Gas Power for Farm and Country Work". "A New Method of Spring Suspension" was the subject of E. E. Wemp's address.

Brobdingnagians of Battle and Business.

Mars is motorized.

Gasoline is greater than gunpowder. Twentieth Century war demands the power of high explosive, put into harness.

Never was an engine of war subjected to such tests as the motor truck in Europe. That the engine in this case was taken from the humdrum commercial field intensifies the triumph. Truly, The Great War will go down as the Automobile Armageddon.

Trains of motor trucks are the chief means of transportation. They carry food for the men and food for the cannon. They carry also the cannon.

By their faith in the motor truck, the Captains of War have shamed the lesser faith of many Captains of Industry.

On the present crazy quilt contour of cramped old Europe, where today's trench is traded tomorrow, railroads do not stay put. What you don't tear up in your retreat, the enemy destroys. Bridges and tunnels are dynamited, embankments effaced, rails warped and terminals razed.

War was the opportunity of the American motor trucks. How did they respond?

The Department of Commerce shows that truck shipments have averaged in value from $2,500,000 to $3,500,000 a month since last fall. MORE TRUCKS HAVE BEEN SHIPPED IN 30 DAYS THAN WERE SHIPPED DURING ALL OF 1913.

It is a war on wheels. Trucks brought up the "Jack Johnsons" that "golumpused" the forts at Liege, Maubeuge and Namur. Gallieni motored 70,000 men from Paris to Meaux, 30 miles, in six hours when he heard Von Kluck knocking at the outer gates of the French capital. Thirty thousand motor vehicles account for the amazing mobility of the Kaiser's forces in the eastern theatre of war. THE MOTOR TRUCK CARRIES THE SUPERIER FORCE TO THE POINT OF CONTACT.

In the rear, in the van, rushing ammunition to the breech of the cannon, hurrying the thousands of wounded to the base hospitals, the truck has travelled over good, bad, worse and even no roads in every plague of weather.

In the destructive work of war-time, the motor truck is no longer on trial. How long will the generals in the constructive work of commerce cling to their time-worn methods of hauling?

What the motor truck has done in a few months in war, it is certain to do more gradually in the more deliberate contests of business. Never before was the motor truck so full of interest for men who are on speaking terms with opportunity.

Ask the man who owns one.

PACKARD MOTOR CAR CO., DETROIT

This striking statement has been widely distributed by the Packard Motor Car Company. It is reproduced because of its extreme value as an argument, that as surely as the use of motor trucks has revolutionized warfare will their use revolutionize highway transportation.

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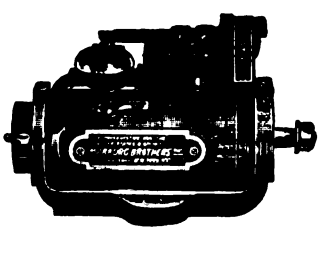

Mea

Magneto

S. R. O. Ball Bearing

MARBURG BROS., Inc.

Sole Importers

Detroit NEW YORK Chicago

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The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., APRIL, 1915 No. 4

IDEAL DEPARTMENT STORE DELIVERY.

Warehouse, Garage and Shipping Room Combined in Large Fire Proof Structure Connected by Subway with Stores of Manufacturers' Outlet Company, Providence, R. I., Insures Large Economies and Greatly Improved Service.

ANTICIPATING so far as possible its distribution and transportation needs, and its requirements for storage, for a period of years, the Manufacturers' Outlet Company, which has the largest department store in Rhode Island at Providence, has concentrated its warehouse with the group of buildings occupied for store purposes in the centre of the business district of the city, and has in this warehouse its shipping department and garage, which, when the plans shall be completed, will afford facilities that will be superior to those of any other department store in America, if not in the world.

This statement may appear a very broad claim when the delivery and transportation departments of the mammoth department stores of New York, Chicago, Philadelphia and other cities, so carefully developed, systematized and equipped are included in this comparison, but it refers to the general plan and the facilities for operating rather than to proportions.

The Fireproof Warehouse, Garage and Shipping Department of Manufacturers' Outlet Company, Pine and Eddy Streets, Providence, R. I.

That the plan shall be understood a brief statement is necessary. The store occupies practically all of the buildings in the square bounded by Weybosset, Eddy, Garnet and Pine streets, the store fronting in Weybosset. The company for a number of years had its warehouse in Lester street, approximately a mile distant. All stock kept in the warehouse was hauled from the railroad terminals and piers and, so far as possible, delivered from the warehouse. The motor delivery wagons were kept at the service station of the Autocar Sales Company, three-quarters of a mile from the store. The machines were in charge of a garage superintendent and the warehouse was in charge of another foreman.

Much time of the vehicles and men was required to haul the stock to and from the warehouse, and this meant unproductive labor and unnecessary expense. The store shipping department

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The Garage Floor with 25 Machines Lined in Their Places—There Is Abundant Space for Storage of Three Times the Number.

is in the basement of one of the main store buildings, and this is decidedly inadequate for the business. Increased space was imperative for this department. The wagons were loaded on the sidewalk in Pine street. This thoroughfare is narrow and pedestrian and vehicular traffic impeded this work. The volume of delivery is constantly increasing and the congestion in the delivery department became more and more pronounced.

More than two years ago the plans that are now being completed were determined, and in July, 1913, the demolition of structures on the site now occupied by the warehouse and garage was begun. The building is practically finished, but some of its equipment is to be installed, and the subway that will be used to convey the packages from the stores to the delivery room, which will be in the basement of the warehouse, is yet to be built. Possibly six months will elapse before the facilities will be fully installed and the system will be completely systematized.

Until December, 1909, the company used horse vehicles exclusively for its delivery and transportation service. At that time it owned about 45 horses and 25 wagons, trucks and drays. Purchases were distributed free in Providence and Pawtucket, within a radius of approximately four miles of the store. Following the first machine other motor delivery wagons were purchased until the store had 13 in service, with two Ford chassis that were used for carrying workmen and tools and light stock from the store to jobs and return, and two two-horse teams that were used for freight haulage.

With the change from horse vehicles to machines the delivery zone was increased to extend 16 miles south to Bristol on the east shore of Narragansett bay, 13 miles south to East Greenwich on the west shore, 14 miles southwest into the Pawtuxet valley, 15 miles northeast to Attleboro, North Attleboro and Plainville in Massachusetts, 10 miles north to Ashton, eight miles northwest to Stillwater and Georgiaville, this being an area roughly 12 times as large. By this is meant that with the use of motor equipment the company served more than 500,000 people against about 300,000 reached with animal vehicles, and competed with the concerns that had previously had no serious competition.

Business Demands Impelled Changes.

It was the business possibilities of this increased area that impelled the changes that are now being realized, and which required a very large investment. The policy of the company is to have the best that can be obtained, which is reflected in the new plant, for while the cost has been large, provision is made for

The Furniture Platform with Five Machines in Readiness for Loading—Two Large Elevators Connect with the Floors Above.

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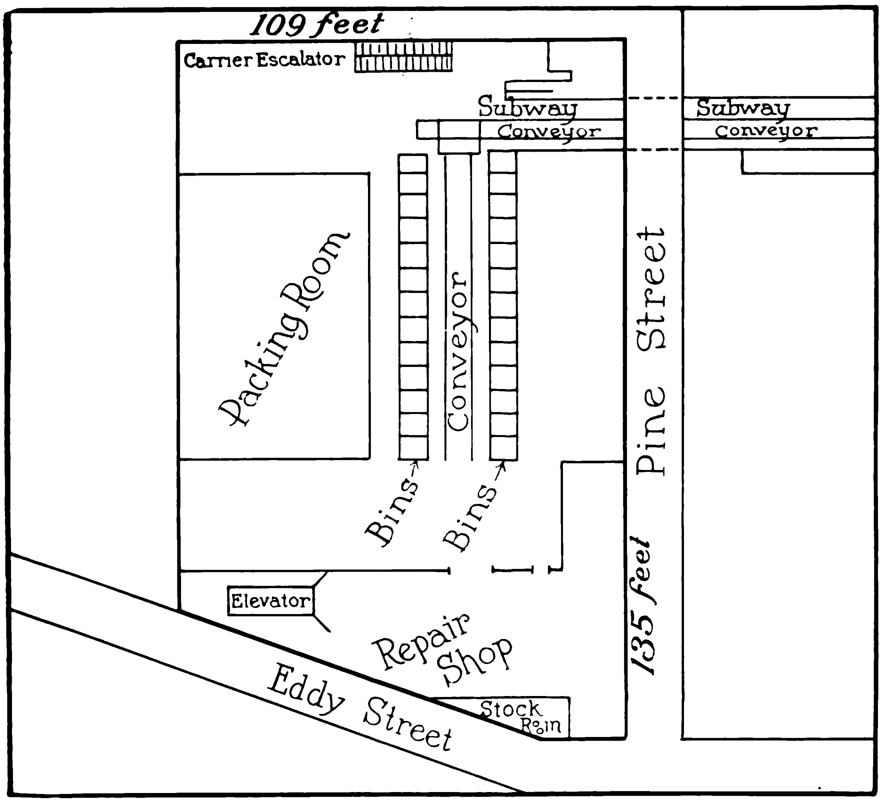
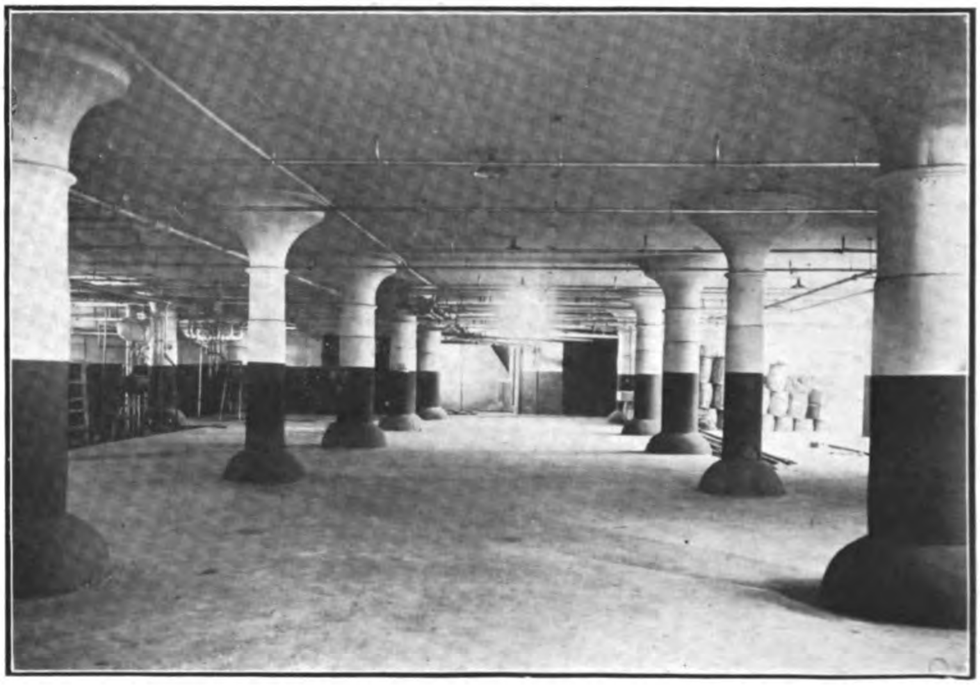


Sketch Showing the General Arrangement of the Package Delivery Room That Is to Be Located in the Basement of the Building, Connected by Subway with the Stores.

future expansion, and without material changes it will serve for at least a score of years. The warehouse is built without a piece of wood in it, aside from the shipping platform of the furniture department and the elevator gates and platforms. It is regarded as absolutely fireproof. The expense of the site and construction was large, but the protection against fire is the best that science can devise.

The Manufacturers' Outlet Company's stores are in a series of buildings, some of which were built for other purposes, and some of which were erected to meet the requirements of the concern. These are connected and the delivery is in the basement of the building originally occupied, about in the centre of the group. Now the packages to be delivered from the stores are collected in wheeled carriers in the different departments and taken by elevators to the shipping room. The company has a very large furniture department, the sales room having more than an acre of floor space, and the deliveries are made separate from the package or parcel routes, for these are usually delivered direct and there is no relation between the furniture and the packages so far as distribution to purchasers is concerned.



The Section of the Basement Where the Package Delivery Room Will Be Established, with the Route Bins and Conveyor Between the Pillars.

The property of the company reaches Pine street and the shipping room is now reached by an elevator from a court from that thoroughfare. Previous to occupancy of the warehouse the packages, after sorting for routes in the shipping department, were placed in carrier trucks and taken by elevator to the court and the street and there sorted by the drivers with reference to the deliveries and packed in the machines. Since the occupancy of the warehouse the carrier trucks are taken across Pine street and to the garage for route sorting and packing in the machines, but this is merely temporary, until the facilities of the company shall be completed.

The new warehouse and garage building is at Pine and Eddy streets, having a frontage of 135 feet in Pine street and a depth of 109 feet, the Eddy street frontage being slightly increased because of it being an angle. This is six stories and basement. The basement will be the shipping room of the store (from which the packages will be sent out) and the repair shop of the garage. The garage occupies the entire first floor of the building. The floors above are used for storage of furniture, kitchenware, the stock room of the wholesale Victrola department, a cabinet shop and for storing furniture held for future delivery.

The floor area of the warehouse is approximately 103,000 feet, including the basement and the garage, but the five storage floors above them have about

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A Section of the Garage Floor Behind the Electric Route Wagons While the Crews of the Machines Are Sorting Their Loads for the Morning Trip.

73,500 square feet, or slightly less than two acres.

Pine street is 40 feet wide between the building lines and the west end of the warehouse is approximately in the centre of the company's store property on the north side of the street. As rapidly as the work can be done the subway will be constructed under Pine street to connect the store with warehouse, and when this work is completed the intention is to do all of the package delivery from the warehouse. The plan comprehends the collection of the packages throughout the stores by carrier trucks at regular intervals, and the bundles will be sent by spiral chutes and conveyors to the collection room at the north end of the subway.

This collection room will receive everything aside from furniture, and here the packages will be deposited automatically on a large belt conveyor that will carry them through the subway to the shipping room of the package delivery department. This will give over practically all of the present shipping room for store purposes and will insure quick transmission from the stores to the delivery department. The furniture is usually sold by sample from the sales room display and orders will be transmitted to the superintendent of the furniture warehouse, who will select the goods from the stock, prepare and deliver them.

The removal of the package shipping room from the store buildings will not in the least affect the service. In fact it is expected to considerably improve it, for the men will have increased space and the best of facilities for working, and this will insure quicker handling and more expeditious delivery. The subway will be of such size that the employees can go from the stores to the warehouse without going into the street, and this will better protect the goods in the event of storm, there will be no possibility of loss and much less handling.

An accompanying illustration shows the greater part of the basement of the warehouse which will be given over to the package shipping room. A sketch illustrates the approximate layout of the room when it will be equipped. This sketch is not to scale or proportions and is used merely to show in a general way the arrangement of the department. The reader will note that the subway enters the basement at the upper or west end of the building, and that the subway conveyor will be at right angles to the room conveyor. The subway conveyor will terminate at the sorting table, and from this the distributing conveyor will extend between two series of route bins into which the packages will be sorted.

Plan of the Shipping Room.

This sorting table will receive all the packages sent into the room through the subway, and at this

Another Part of the Main Floor When the Gasoline Machines Used for the Long Routes Are Being Loaded for the Day's Distribution.

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The Cutler-Hammer Charging Switchboard, Which Is Equipped to Charge Either Six or 12 Machines.

point all the packages will be examined for the address and the numbers of the routes marked on them. They will then be placed on the distributing conveyor and sent between the bins, and boys will place them in the route bins that are indicated by the numbers. The route sheets will be written after the packages have been placed in the bins, being taken from the compartment in which they were originally placed and deposited in another when the sheet entry has been made, and they will then be taken by the drivers from the bins in carrier trucks. The usual type of elevator will not be used to lift the carrier trucks to the garage floor, where the loading will be done. Instead there will be a two-way escalator that will be adapted for carrying the trucks and which will be constantly operated during the periods of loading. This will obviate waits or delays, for the escalator can be used by a number of men at the same time and there will be a much less element of danger. While this will have capacity greatly in excess of normal requirements, it will be a decided advantage when sales are in progress, when the volume of business may be increased three times. The average number of packages handled daily is 4000, but 12,000 or more are distributed a day a number of times a year.

Equipment Specially Constructed.

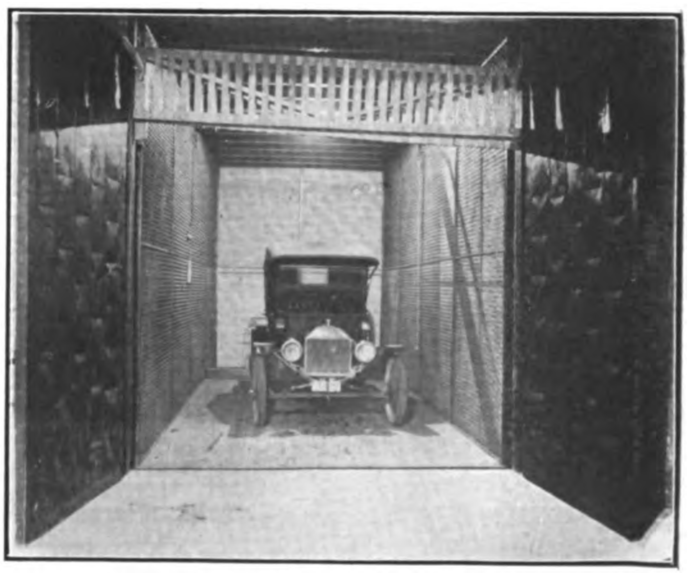
The equipment of the shipping room will be as simple as is possible, but it will be specially built to meet the conditions and the requirements, and there will be ample space for the drivers to load the carrier trucks and move them to and from the escalator. The machines will be placed in the garage so that the drivers and helpers can work behind them and sort and pack their loads quickly. The original intention was to have the packages sorted on the second floor of the building and send them by gravity to a loading platform at which the machines were to be placed in regular stations, but this was given over because of the congestion that would be necessitated in the event of sales when three times the platform space would be necessary.

With the present plan the entire floor of the garage can be given over to loading when demand arises. The company now has 25 machines in use and three times the number could be housed, so that there is a very large excess of space in normal business periods, and all that will be required during sales, even if the equipment were doubled, by loading in relays. Basing estimate on the annual increase of business, the company believes that it has made provision for probable growth for a long period of time.

The Garage and Its Facilities.

The building is constructed of brick, steel and concrete, and is six stories above the basement, but it is very high, as the height of the garage floor is 21 feet and the second story is 15 feet. The basement will contain the package shipping room and the garage repair shop, these being separated by a half partition of wood and a wire screen extending to the ceiling. In the repair shop is a motor and overhead shafting that drives a lathe, grinder and drill press, and the other equipment includes an arbor press, benches and tools. There is a stock room where all spare parts and supplies are kept. The repair shop has a large elevator, that runs to the garage floor, for raising and lowering the machines. This is large enough to raise or lower a truck of five tons capacity. There is space in the repair shop for five machines without congestion.

The repair shop is in the east end of the building. Above it in the garage floor is the receiving and loading platform for the machines used for furniture delivery, there being two large elevators that run from this platform to the top floor. These elevators are operated in separate wells. On each floor are doors that are a drop type and so equipped that in the event of fire they will automatically drop, shutting off the wells from the different floors. At the west end of the building is a passenger elevator and a stair case



The Truck Elevator to Take the Machines from the Garage Floor to the Repair Shop in the Basement.

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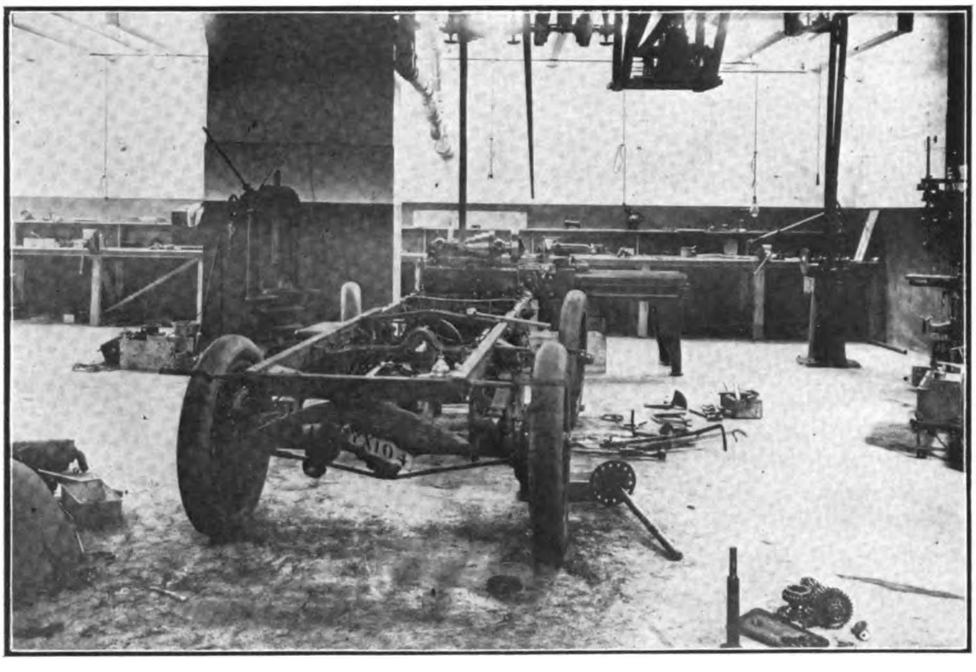
that is enclosed within walls, with metal doors between it and the stock rooms. The floors are concrete and are supported by concrete and steel pillars. The frames of the windows are steel and the windows are glazed with wire glass. Besides the side windows the top floor is lighted with large skylights.

Fully Protected Against Fire.

The building is protected against fire by an elaborate system of automatic sprinklers. The structure is heated by steam from a central boiler house that heats the stores, and in the event of fire the steam is to be shut off and the steam mains and pipes are to be used as a water system that will serve each floor, sufficient pressure being maintained by powerful pumps located in the basement. Each floor is so constructed that it cannot be flooded, for the water used in the event of fire will be carried off by large drain pipes in the walls. The lighting mains are enclosed in pipe and the entire illuminating system is controlled by switches in a fireproof switchboard room in the basement. The electric current is supplied from an outside source. The main entrance to the garage is in Pine street, but there is also an entrance in Eddy street, so that machines can be driven into or from the garage without a special arrangement of the vehicles on the floor to afford a passage. The doors are telescopic and are raised and lowered by electric motors, they being balanced so that small power is required for operating them. Besides these doors there are two other entrances, the one to the staircase and the other to the main floor of the garage.

An accompanying illustration was made with all of the delivery machines of the company in the garage, and reference to this will show what a large area is available for loading and for storing additional vehicles as the equipment is increased. The picture was made from the furniture delivery platform and does not show a considerable part of the floor.



The Repair Shop Well Lighted by Day and Equipped with Machine Tools Sufficient for Any Kind of Work.

The vehicle equipment of the company consists of 25 machines of all kinds, of which 13 are 3000-pound capacity Autocars with special bodies, nine are Commercial Truck Company's electric, and three are Fords. Seven of the Autocars are used for package delivery, two covering routes in the city and the others reaching the suburban cities and towns; three are used for furniture delivery, two for special delivery and one is a reserve in the event of a withdrawal of any of the regular machines. Of the electrics, five are used for city package delivery, these being 1000-pound wagons; two 2000-pound machines are used for furniture delivery, and a 4000-pound and a 7000-pound electric truck are used for the haulage of freight to the warehouses and stores from the railroad terminals and piers. One of the Ford machines is used by the awning department to carry men and material to jobs, another is utilized for a similar purpose by the carpet department, and a third is given over to general work for the different departments and the garage superintendent, who makes trips about to observe the men serving the different routes.

The work done by the machines is best shown by the average mileage. Routes 1, 2, 3, 4, 5 and 6 are practically in Providence. Of these routes 1 and 2 are served by Autocars, and the others by 1000-pound electric wagons. These routes are covered three times daily, the machines leaving the store at 8:30, 1 and 4 o'clock the first five days of the week and at 9, 2 and 5:30 Saturdays. But one delivery is made on Fridays during July and August. These machines will average 13 miles to a trip, or approximately 40 miles a day. Route 11, which is also in the city, in South Providence, and has two trips a day, morning and afternoon, with one trip Fridays during July and August, is covered by a 1000-pound electric that is driven an average of 45 miles a day.

Gasoline Machines for Long Routes.

The other routes, which are long, are served by Autocars. No. 7, which reaches Bristol, makes an average of 75 miles daily; No. 8, which is to Pawtucket and the Attleboros, averages 65 miles; No. 9, which makes a circuit through parts of Pawtucket and a number of towns north and west of Providence, and in Providence, averages 60 miles; No. 10, which makes a similar circuit through the city of Cranston (which city has an area of 50 square miles), averages 65 miles, and No. 15, which serves the west shore and the Pawtuxet valley villages by making a loop through one

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section of Cranston, Warwick, West Warwick, East Greenwich and Coventry will vary from 75 to 110 miles a day. All of these routes are covered once daily, the start being made from 9:30 to 10 o'clock.

The three Autocars used by the furniture department make the long trips, and delivery is made anywhere in southern New England, purchases being frequently sent 100 miles, as far west as New London and Hartford, Conn., to places 75 miles north, to points northeast of Boston, and all over southeastern Massachusetts. The two electric machines in this department are utilized for city and suburban delivery. The mileage of the furniture wagons is extremely variable and cannot be averaged. The Autocars used for special work may be sent with route loads or with single deliveries, according to the conditions, and the reserve machine is used as occasion requires.

City Routes Increased in Length.

In the utilization of electric machines for city delivery, the company has supplanted all its horses, increasing the lengths of the routes about three miles each, and it has improved the service by giving three deliveries where in some instances but one was previously given, and in others increasing the deliveries from once to twice daily. The purpose of the company is to meet every demand for distribution, and this has been done, especially outside of the city. The suburban and long distance delivery is very carefully planned and all the machines are sent out heavily loaded. Future development will be increase of the number of these routes and probably more frequent trips. These probable changes will be made as occasion demands and will mean more gasoline machines.

The policy of the company is to use those vehicles which appear best adapted to its requirements, and the reader will note that no change has been made in the make of gasoline wagon since the first Autocar was placed in service more than five years ago. The electric wagons were installed early in February of the present year, one purpose being to minimize the consumption of fuel necessary with gasoline wagons where many stops are made, and the drivers must crank the engines after each stop or keep them running.

The drivers are each accompanied by a helper, unless the loads are unusually large, when a second helper is sent. The city route wagons deliver from 250 to 400 packages each a day, which gives an idea of the work that must be done by the crews. For the men to do their work to the standard the wagons must deliver practically a package a minute while actually engaged in distribution. This is not equalled on the suburban routes because the distances are greater and the stops further apart.

The Battery Charging Switchboard.

The garage is equipped with one of the latest Cutler-Hammer switchboards for charging, and this is so fitted that six circuits can be given 125 volts each, or 12 circuits 125 volts each, this being governed by the use of double-throw switches. The garage has 12 charging stations, and this is three more than is now required. The machines, save one, are equipped with Edison batteries, the one having an Ironclad Exide battery.

The company has, by combining its garage and shipping or delivery departments, eliminated the waste mileage driven between the store and the garage, it has placed the machines and the men where they are, unless engaged on the routes, directly under the supervision of the head of the delivery department and the superintendent of the furniture warehouse, and minimized handling as well as expedited the distribution. The economy in reduced mileage is a large item in the aggregate, the saving of time in the event of additional machines being required is a factor of importance, and the better facilities for sorting and packing the loads, the protection of the packages and stock from storm, the escape from street congestion, the lessened cost of insurance, the security from fire, the facilities for handling greatly increased volume of business, the greater convenience and comfort of the employees, and the better satisfaction of patrons, are results of practical value through the concentration of the warehouse and garage with the stores. The initial expense was large, but the economies are in ratio to the cost. The progressive policy of the company is evidenced by the fact that its delivery facilities and equipment are not equalled with the largest and most prosperous concerns of the country.

A NEW GAS-ELECTRIC TRUCK.

A gasoline-electric truck has been designed and put upon the market by the Blair Manufacturing Company of Newark, O., which for several years has been making gear driven trucks. An experimental truck has been built and thoroughly tried out and production commercially has been begun.

The distinctive feature of Blair trucks has been a sub-frame hinged to the main frame at the front end and supported at the rear by trunions concentric with the driving worm at the rear axle. The idea was to make the use of universal joints unnecessary and relieve the operating parts of all distortion caused by uneven road surfaces.

In the gas-electric design this feature has been retained. The gasoline motor is placed as previously, but instead of a clutch and flywheel is a direct connected electric generator. Behind this is an electric motor which drives the truck through a worm reduction. An electrical controller at the driver's seat provides for changes of speed. The entire power plant is mounted on the sub-frame.

Max Mannesman, a well known German truck manufacturer, died recently of pneumonia, contracted in the trenches while inspecting the ambulance service. Small truck chassis manufactured by him and fitted with ambulance bodies is the mainstay of the German sanitary staff.

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DUPLEX FOUR-WHEEL DRIVE.

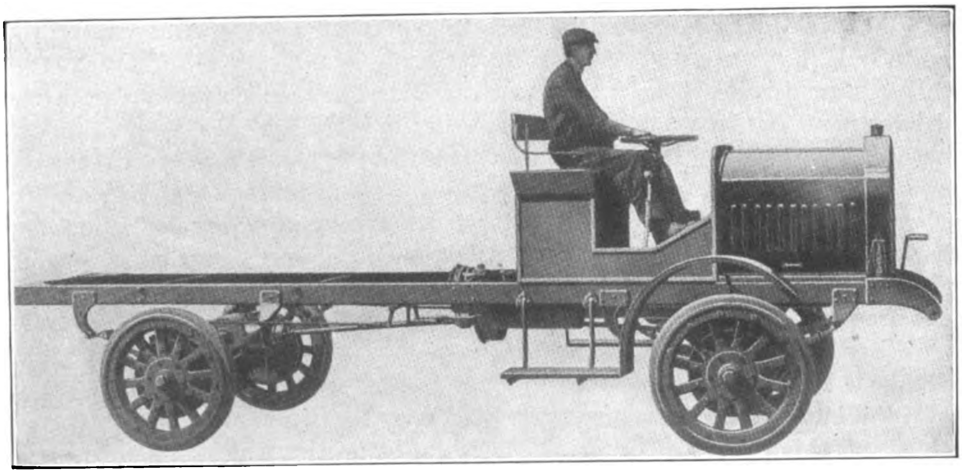
Large Economy of Power Results in Small Operating Cost for Work Given.

Scientific determination extended over a considerable period of time, which affords opportunity for development and new applications, is more to be depended upon than the one investigation or inquiry, because of the larger possibilities and the greater knowledge that results. The experience of the Duplex Power Car Company, Charlotte, Mich., which has extended over a period of nearly seven years, has been paralleled to a considerable extent by that of the French ministry of war, which for six years annually organized competitions in which the largest manufacturers and leading engineers of France participated.

These trials were primarily for the purpose of determining qualities of the different machines produced each year, but they also served to stimulate the industry of the nation to develop vehicles that would attain the standards of efficiency and quality required for military service. Each year the competition attracted larger numbers of competitors, and the machines were designed, constructed and participated in the contests to attain the prestige that government preference and award would bring to the builders.

Practically every type of machine that has been designed for highway transportation was tried in the trials, and the conclusion finally reached by the military engineers was that the most serviceable, most enduring and most economical vehicles for army haulage in every possible condition were those driven by four wheels, and which carried the loads practically equally distributed instead of a large percentage on one axle.

The competition of France for 1914 was terminated about a week before the date officially set because of the war, and the official figures and deductions have never been made public. But basing conclusions on the findings of the department in the years previous, statement may be made that the four-wheel drive has been found much superior to all others, a claim that is made by the Duplex-Power Car Company for the two and three-ton machines it builds.



Two-Ton Duplex Stripped Chassis, This Being the Size Adopted for the Signal Corps Service of the United States Army.

CHEAP GASOLINE BY NEW METHOD.

A new electro-chemical process for the transformation of crude oil into gasoline, by which its inventor, Louis Bond Cherry of Kansas City, Mo., claims that gasoline can be profitably produced at three cents a gallon has been attracting some attention. The exact details are not published, but Cherry is quoted as saying:

"Ten thousand gallons of 30-gravity distillated oil can be changed by this process into 11,900 gallons of 65-gravity gasoline. All of the volatile parts of the oil are converted into gasoline and it takes only one cubic foot of natural gas and five kilowatts of electricity to effect the transformation. Thus the cost of the conversion is less than .75 of a cent per gallon."

STUDEBAKER EMPLOYEES SHARE PROFITS.

Statement is made that the Studebaker Corporation, Detroit, Mich., has distributed approximately $300,000 in sums ranging from $250 to $4,000 as profit shares among its department heads, superintendents, and foremen in charge of production. All participating in the plan are connected with the Detroit plants, with the exception of district managers. It is said that the corporation intends to extend its plan this year to include many of those employees who have served a long time, basing the individual proportions on the increase of production, and individual effort in the curtailment of expenses.

GOODYEAR'S NEW GUARANTEE.

The Goodyear Tire and Rubber Company, Akron, O., has inaugurated a new guarantee in behalf of its S-V truck tire, whereby purchasers of those tires for a period of three months are guaranteed that if the tires do not outwear competing tires by yielding lower cost per mile, the entire purchase price will be refunded.

"The conditions are simple," stated C. W. Martin, Jr., manager of the motor truck tire department, "and are outlined in the agreement covering each sale, S-V tires to start running some time as competitors, on the same truck, in same positions—that is, front against front, rear against rear. S-V's must be of the same rated size as competing tires and the latter must be competitors' regular advertised product, purchased in the open market." The guarantee is now effective.

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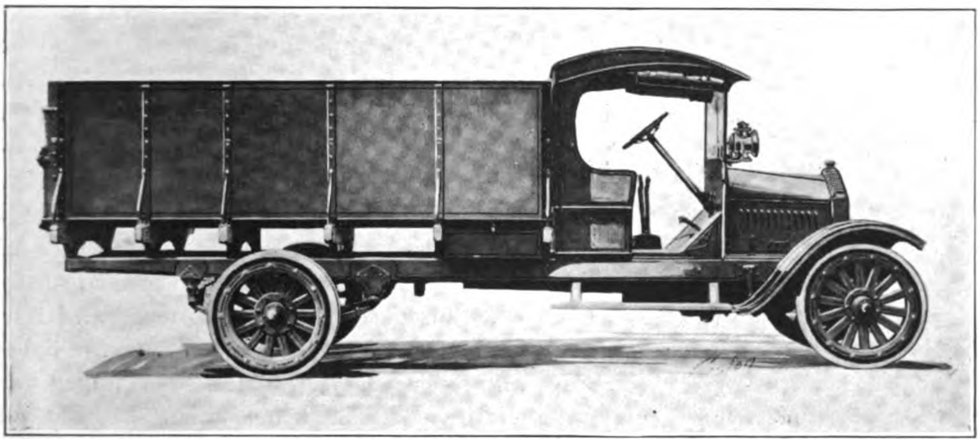
THREE SIZES OF WORM-DRIVEN TRUCKS.

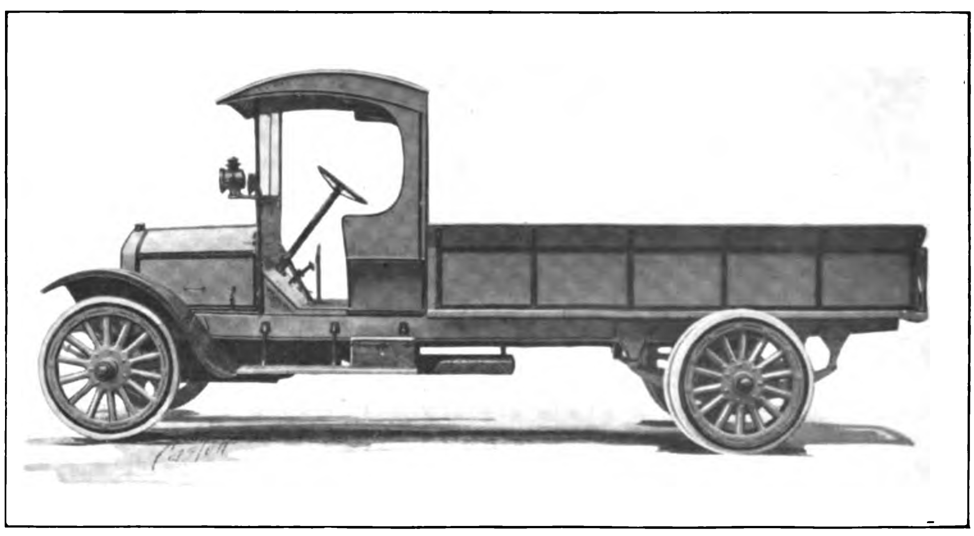
ADOPTING as standard a design that was first produced early in 1914, the Chase Motor Truck Company, Syracuse, N. Y., is now constructing three sizes of these machines, with slight modifications from the initial production, which are designated as models O, R and T. The company has discontinued the manufacture of all types previously built, but will supply parts for these machines so long as any are in service.



The Model O 7000-Pound Chassis Equipped with a Body Adapted for Bulk Loads, Installed on Large Frame Bolsters.

The new standardized line of Chase trucks are worm driven, and in them are incorporated several features that have been adopted as standard practise by European truck builders. The machines are constructed of components that have been designed and developed by some of the leading specialists of the industry, and these are constructed from high-grade materials, by expert workmen, and are known to be unusually economical and efficient in hard and constant service.

The model O truck is 7000 pounds capacity, the model R 3000 pounds capacity, and the model T 1500 pounds, the model O being increased from the 6000-pound rating of the first machines built. The Chase designs were not hastily created. They were determined after careful study and investigation of the best practise of the foreign builders and a broad knowledge of the requirements for American highway transportation. Experience with owners and operators of power wagons for nine years impelled the standardization of the machines, and this intention to standardize caused an exhaustive inquiry into every phase of service and operation before the models were regarded as satisfactory.



Model R 3000-Pound Chassis with a Standard Chase Cab and a Flareboard Express Body.

Simplicity has been sought in these machines so far as is practically possible. The power plants are with the engines, clutches and transmission gearsets assembled as units, and the drive is by long shafts to worm and gear wheel full floating rear axles, the construction being the overhead worm or David Brown type. The frames are built to yield to the driving stresses instead of having rigidity, and the strains from chassis distortion are minimized. The moving parts of the chassis are extremely well protected, being enclosed to exclude abrasive substances and water, and all parts are designed with unusually large factors of safety to insure long endurance in all conditions of service.

The units included are Continental motors, Brown-Lipe multiple disc clutches and selective transmission gearsets, Sheldon axles, Sheldon springs, Timken bearings, Bosch ignition systems, Holley carburetors, hydraulic pressed steel frames and Pierce speed controllers, and all the other elements of the machines are of equally high standard. The assemblies have been very carefully thought out and the machines are sightly and harmonious, as well as distinctive in appearance.

Difference in Motors.

Considering the different types, while they are practically to one design and differ essentially only in proportions, there is a slight difference between the motors, although built by the same concern. The motor of the model T machine is the Continental model N, which has a cylinder bore of 3½ inches and stroke of five inches, and is rated at 19.6 horsepower by the

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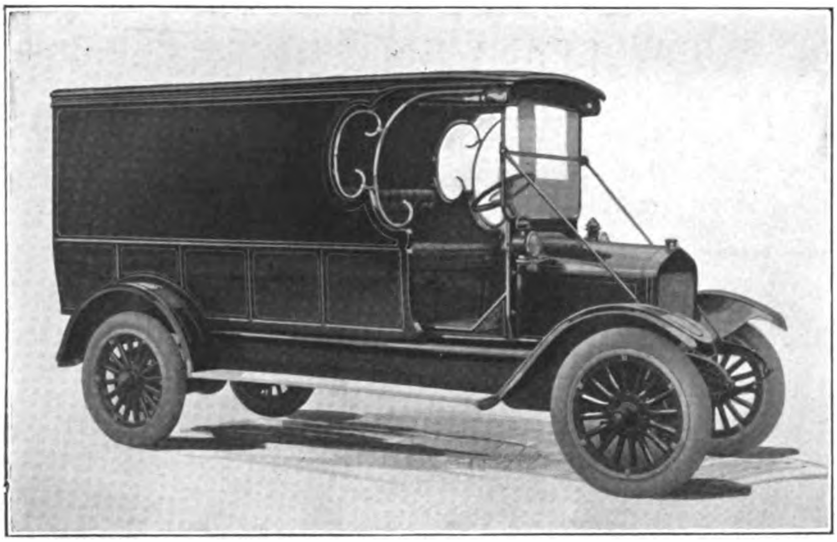


Model T 1500-Pound Chase Chassis with a Full Panel Body Adapted for General Light Delivery.

S. A. E. formula. This is an L head type, with the cylinders cast en bloc, with the head open, this being closed with a large cover plate retained by cap screws. The pistons are, because of their design, cast without the reinforcing ribs for the heads, and are fitted with three rings, each 3/32-inch face. Much care is taken in machining and finishing the cylinders and pistons.

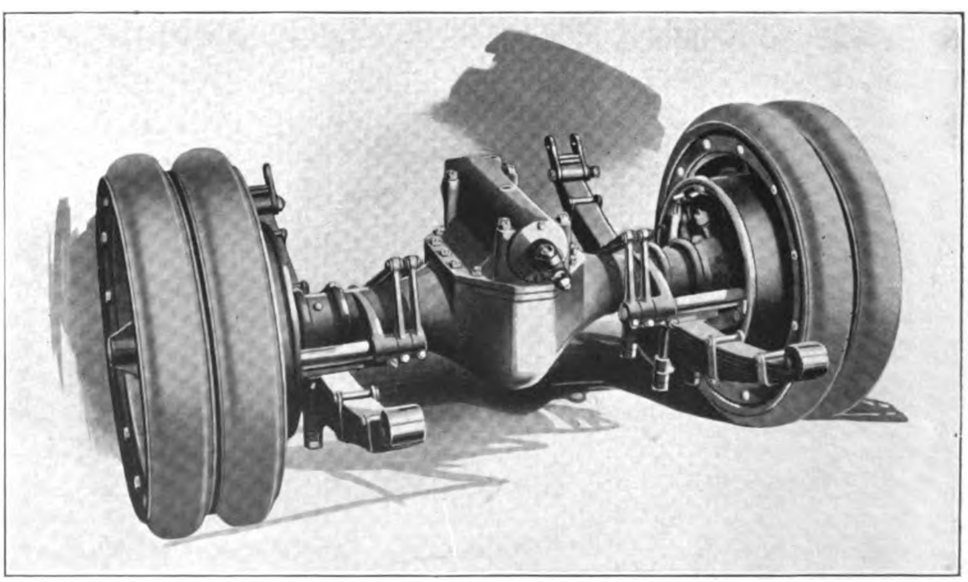
The crankcase is an aluminum alloy casting with a bell housing that encloses the flywheel, and a forward extension of large size houses the timing gears, which are three in number. The deep base of the crankcase, which is attached by bolts, is the oil reservoir. The rear supporting arms of the power plant are integral with the crankcase. The crankshaft is mounted on three babbitt bronze-backed bearings, which are respectively 2 9/32, 2½ and three inches length, and the bearings are 2 3/16, 2 7/32 and 2¼ inches diameter. The flywheel flange is forged integral with the shaft. The crankpins are 1⅞ inches diameter and 2 3/32 inches length. The connecting rods are drop forged steel I sections and the wristpins are hardened chrome nickel steel. The wristpins oscillate in phosphor bronze bushings.

The camshaft is a two-bearing type and is mounted on two very large bearings. The valve action is conventional, much care having been taken in timing to insure engine efficiency. The timing gears are helical cut and are practically noiseless. The motor is lubricated by the Continental system of force feed and splash, the timing gears and rear main bearing being flooded and the excess filling the pits from which the oil is distributed by splash. The condition of the oil supply is indicated by a float-operated gauge. The motor is cooled by a thermo-syphon circulation of water through the jackets of the engine and a radiator, and by a fan mounted on an adjustable bracket driven from a pulley on the extension of the magneto shaft by a flat belt.

The Motor for Model R Truck.

The motor of the model R is the Continental model C, this being an L head type with the cylinders cast en bloc. The bore is 4⅛ inches and the stroke is 5¼ inches, the S. A. E. rating being 27.2 horsepower. The water jacket head is cast separately and is retained by a series of cap screws. The pistons are fitted with four eccentric split rings and have five oil grooves. The crankcase is an aluminum alloy cast in two sections, the upper part carrying the three main bearings and the lower half containing the oil reservoir. The crankshaft is 1¾ inches diameter and it is mounted on bearings that are from front to rear 2¾, three and four inches length, and the crankpins are 1¾ inches length. The shaft has flanges to insure against end thrust. The camshaft is forged with the cams integral and is mounted on long nickel babbitt bearings. The timing gears are helical cut and the valve mechanism is adjustable and is enclosed. The bearings are very large and the connecting rod bearings are fitted with steel shims. Lubrication is by plunger pumps driven by eccentrics from the camshaft, which flood the rear main bearing and the timing gears with oil, and the drainage into the base of the crankcase is constantly at a level for the splash distribution. The motor is cooled by water circulated by a centrifugal pump through the water jackets and a large radiator, and by a fan.

The motor of the model O truck is the Continental



The Sheldon-Made Rear Worm and Gear Wheel Axle, Showing the Chase Designed Spring Installation, Which Is a Feature of These Machines.

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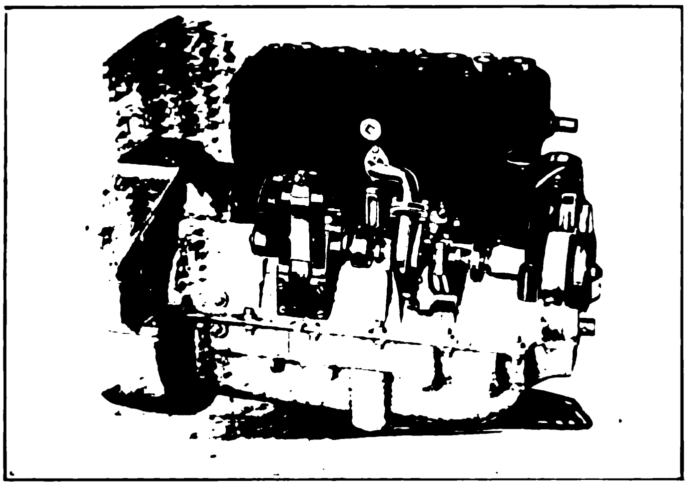


Type of Continental Motor Included in the Unit Power Plants of the Chase Trucks.

model E, which is an L head type with the cylinders cast in pairs. The cylinder bore is 4½ inches and the stroke is 5½ inches, the engine being rated at 32.4 horsepower by the formula of the S. A. E. These cylinder units are fitted with large water jacket heads that are retained by cap screws, this construction insuring an efficient cooling system. The detail of the construction of this motor is practically the same as the model C engine, but the dimensions differ, the crankshaft having 1⅞ inches diameter with three bearings, three, 3 11/16 and 4½ inches length, and the camshaft is 2¼ inches diameter, with three bearings. The valve ports are 2¼ inches diameter. The intake and exhaust manifolds are secured with clamp bars instead of studs and nuts. The cooling and lubrication systems are the same.

All of the power plants are mounted on three points. The radiators of models T and R are built-up types with finned tube cores, which are mounted on frame cross members, cushioning protecting them against chassis distortion. The radiator of model O has a cast finned top and cast base and water columns with finned tube core, the assembly being mounted on springs to avoid strains from frame weaving.

Clutches, Gearsets and Rear Axles.

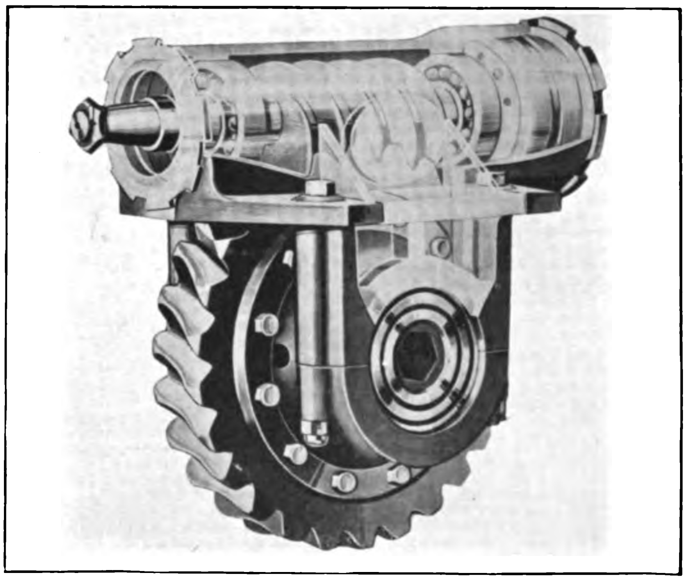
The clutches are multiple disc types that are operated dry, the plates being faced with Raybestos. They are said to be remarkably efficient and easy of engagement. The transmission gearsets are selective sliding gear constructions, those in models T and R having three forward speed ratios and reverse, and that of model O four forward speed ratios and reverse. The gears are wide face and the shafts are large and are mounted on Timken bearings. The driving shafts are 2½-inch diameter steel tube with Blood Brothers' block and trunnion universal joints at either end. The large diameter of the shafts insures against whipping. The couplings with the worm shafts are telescopic to obviate end thrust.

The rear axles are Sheldon designed, the worm shaft and gear being so installed in the axle housing that they cannot be out of alignment after adjustment. The differential is assembled with the gear and the assembly and the driving shafts are mounted on annular ball bearings of large size, with special thrust bearings for the worm shaft and differential. The I section front axles are special Chase design, drop forged from special analysis steel, with drop centres. The spindles are large and are heat treated. The wheels are 36 inches diameter, model T having 2½-inch tires forward and 3½-inch tires rear; model R having 3½-inch tires forward and 3½-inch dual tires rear, model O having five-inch tires forward and five-inch dual tires rear.

Frames and Steering Gears.

The frames are Chase designed, made of cold pressed steel channel section, with the forward ends necked to afford short turning radius. The frames are strongly reinforced and braced. The springs are Sheldon construction, semi-elliptic, of special alloy steel and heat treated. The spring eyes are bronze bushed and the spring bolts are hardened and ground and fitted with large grease cups. The forward springs are mounted on generous spring seats, but the rear springs are underslung, the axle housing being specially adapted for this construction. There are no radius rods, the drive being through the rear springs, a practise that is common with European designers.

The steering gears are worm and nut types, with ample provision for adjustment, and there are ball thrust bearings above and below the worm mast, the mast being 2¼ inches diameter. The steering connections are all Chase designed and spring shock absorbers are fitted to minimize the stresses upon the worm or hand wheel. The left foot pedal operates the clutch and the right pedal the service brake. The emergency brake lever and the gear shifting lever are in the centre of the footboard. Both the service and the emergency brakes operate on drums on the rear wheels, the braking surfaces being very large, insuring safety in all operating conditions without possibility of destroying brake efficiency. The means of adjusting the brakes are very accessible.



The Sheldon Worm Shaft, Gear Wheel and Differential Assembly, Used in All the Chase Machines.

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The drive of models R and O is right side and that of model T is left side, the control levers being in the centre. The fuel supply is controlled by the throttle lever on the steering wheel and the foot accelerator. The ignition is not regulated by hand lever, the spark being automatically advanced to meet the requirements of the motor at differing speeds. The gear shifting levers are fitted with finger latches, which must be raised before machine can be reversed.

Unusual care has been given to lubrication. All of the wearing surfaces are large and generally provided with means for adjustment, while liberal oilers and grease cups are placed to insure thorough lubricity. The chassis are sold in the lead, or they are equipped with standard types or special bodies, the body department of the company having facilities for producing any work that may be required.

CHICAGO TAXI RATES CUT.

Following the enactment of an ordinance by the Chicago council cutting the taxicab rates in that city, a further shake-up has been given the situation by the entrance into the field of a new company which will establish a scale of rates lower than those required by the ordinance. This is the Atlas Company, which will operate a fleet of 25 Chalmers limousines.

The rates in Chicago had been 70 cents for the first mile, 10 cents for each additional quarter mile, 20 cents for each additional passenger and $1.50 for each hour of waiting. The ordinance made them: 60 cents for the first mile; 10 cents for each additional quarter mile; 15 cents for each additional passenger, and $1.50 for each hour of waiting; the Atlas Company announces the following: 50 cents for the first mile; five cents for each additional quarter mile; 10 cents for each additional passenger, and 80 cents for an hour's waiting.

Whether the established companies will meet this cut has not yet been announced.

$2,000,000 CUT FROM GOODRICH CAPITAL.

Stockholders of the B. F. Goodrich Company, Akron, O., voted at the annual meeting held in New York City, March 10, to reduce the 7 per cent. preferred capital stock from $30,000,000 to $28,000,000, which reduces the total capital stock from $90,000,000 to $88,000,000. Only 3 per cent. of the original $30,-000,000 issue is called for annual retirement, according to the by-laws of the company. While the number of directors was reduced from 16 to 14, the old officials were retained in office, they being: B. G. Work, president; C. B. Raymond, secretary; W. A. Means, treasurer; A. H. Lehman, chief engineer; W. O. Rutherford, sales manager; E. C. Tibbitts, advertising manager; E. C. Shaw, factory superintendent; Charles Wolf, purchasing agent.

DANGER OF RED TAIL LIGHTS.

Railroad officials attribute a number of disastrous wrecks to red tail lights on the rear of automobiles, not to mention frequent delays to fast expresses and the demoralization of engineers' nerves from the same cause. They point out that many highways run closely parallel to railroad tracks, and, at night, the red tail light on an automobile is not distinguishable from the danger signal of track men. This causes the engineer to slow down or stop, until he finds the true identity of the light. Frequent repetition of such incidents tend to make the engineer careless, until some night he runs by a danger signal, believing it to be an automobile light, and maybe a disastrous wreck is the result. While the contention may be far-fetched, there is plausibility in it, and recognizing the possibility, the Vermont legislature has passed a law prohibiting the use of red lights on automobiles. The law will go into effect as soon as similar laws are passed by the neighboring province of Quebec and the states of New Hampshire, Massachusetts and New York. Such a law has been adopted by Quebec.

TRUCK EXPORTS INCREASE 432 PER CENT.

While the value of total exports of motor vehicles from the United States in 1914 increased 5 per cent., the value of motor trucks, as shown by the official export records of the National Automobile Chamber of Commerce, increased at the unprecedented rate of 432 per cent. over the preceding year. The commercial vehicle manufacturers of the United States sent to foreign lands 3430 machines, valued at $8,985,753 during 1914. In 1913 the record was 1009, valued at $1,686,-807. This demand for motor trucks is caused principally by the warring nations of Europe buying here. The total exports of all kinds of motor vehicles for 1914 was reported at 25,765, valued at $28,507,464. Imports of motor cars dropped from 492, valued at $1,154,873, in 1913, to 296, valued at $493,305, in 1914.

PLAN FOR GASOLINE MANUFACTURE.

The manufacture of gasoline and chemicals used in the production of ammunition and dyestuffs under the newly announced Rittman process will be conducted by a company under the supervision of the Secretary of the Treasury, if plans which officials of the United States Bureau of Mines are considering should prove satisfactory. One plan suggests that oil refiners cooperate in building a plant for the company, while another proposes that the sole control of the patents and the right to license financially responsible companies be vested in the Secretary of the Treasury. The full details of the Rittman process will soon be announced by the Department of the Interior, it is expected.

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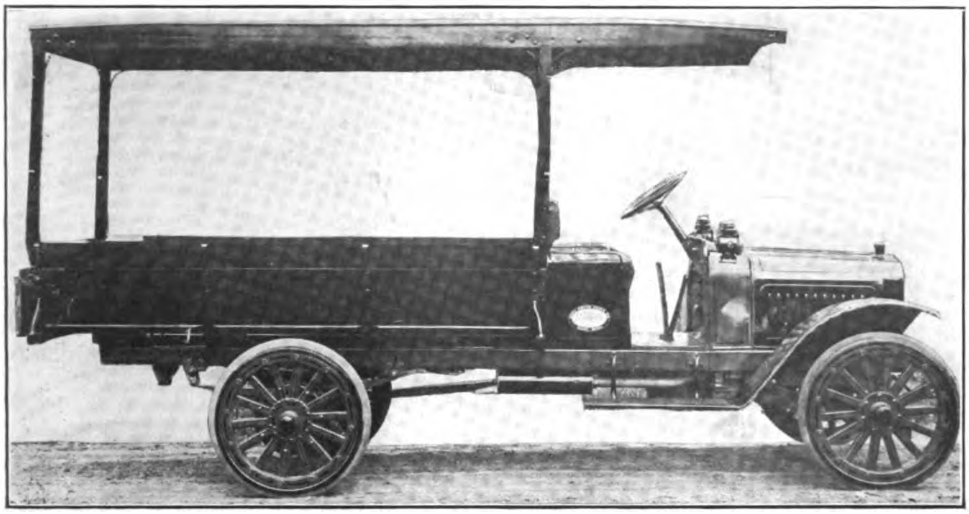
THREE SIZES OF REPUBLIC TRUCKS.

COMMERCIAL production of its 1500 pounds load capacity delivery wagon, which followed an extremely careful inquiry into the transportation requirements of business men for a period of 18 months by the Republic Motor Truck Company, Alma, Mich., completed a series of vehicles built by it that is sufficient to meet practically 75 per cent. of the demands for all highway haulage equipment. The series includes two other vehicles of 2000 and 3000 pounds capacities.



Republic 1500-Pound Chassis Equipped with an Express Body and Standard Canopy Top.

The purpose of the Republic company has been to produce machines that can be sold for moderate prices, and which will be extremely enduring and can be practically operated for comparatively small expense. In the construction of these vehicles the different units have been selected from the products of the best specialists of the industry. The parts are recognized as standards that have been very carefully developed and perfected, and are known to have quality and ample factors of safety.

The prices of the machines are moderate, the 1500-pound vehicle selling for $995, the 2000-pound for $1350 and the 3000-pound for $1475. The light wagon is driven by shaft and jackshaft on the rear axle, with pinions meshing with internal gears on the rear wheels, and the 2000 and 3000-pound machines are driven by side chains from sprockets on the jackshafts and the rear wheels. The design of each vehicle was determined after comprehensive study of the conditions of service for which they are adapted.

The internal gear rear axle was chosen for the ¾-ton truck only after careful and exhaustive rear axle experiments on the heaviest clay roads and the smoothest pavements had proved it to be a type that would operate successfully under all operating conditions. The construction is said to be such that it is very economical and its design affords unusual accessibility, this minimizing upkeep and maintenance expense.

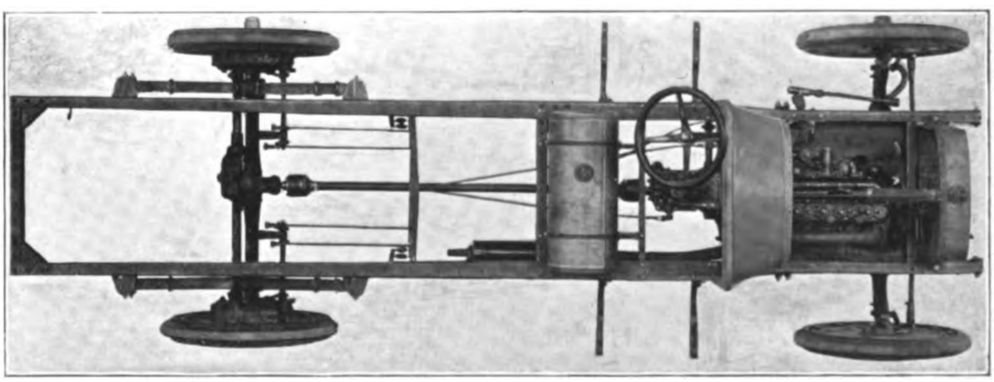
The motor of the 1500-pound wagon is a Continental model O, a long stroke type, having a bore of 3½ inches and stroke of five inches, and the motors of the 2000 and 3000-pound models are of the same make, but of larger size, having bore of 3¾ inches and stroke of 5¼ inches.

The object of the designer has been to provide trucks strong enough to carry the rated loads under all operating conditions, and have a factor of safety sufficiently large to insure long endurance. To attain this the dimensions of bearings, spindles and similar parts are unusually large.

Standard Components.

The principal units of the 1500-pound truck include a Continental motor, Torbensen internal gear rear axle, Fuller & Sons multiple disc clutch, Fuller & Sons transmission, Bosch magneto, Stromberg carburetor, Sheldon front axle and Firestone tires.

The motor is lubricated by a constant level oiling system maintained by a plunger pump, which circulates one gallon of lubricant, and it is cooled by a thermo-syphon circulation of water through a vertical round tube radiator. The motor has four 3½ by five cylinders, cast en bloc from a special grade of reverberatory air furnace iron. To reinforce the two weakest points in a cylinder casing, the head and the base flange, they have been given unusual weight and made with exceptional care. The cylinder base flange



Plan View of the Republic 1500-Pound Internal Gear Driven Chassis.

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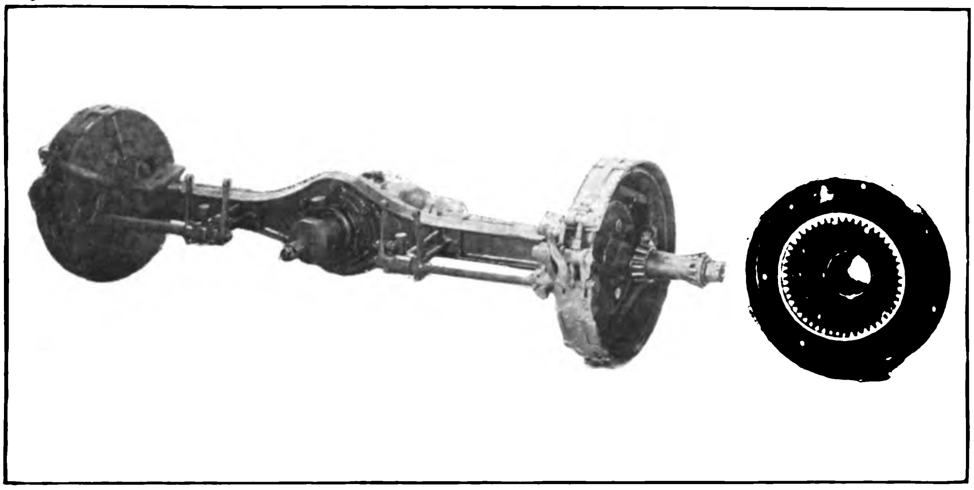


The Rear Axle of the Republic 1500-Pound Chassis, Showing the Internal Gear Assembly and Wheel Drum.

is extended to carry the guides for the valve lifters. This makes it possible to house in the valves push rods and their guides, protecting them from grit and dust. The water jacket head is cast separately and is held in place by screws. It can be easily removed. The enclosed valves of ample size are all on one side of the motor and are operated by a single camshaft. The inlet and exhaust valves are interchangeable. They have nickel steel heads welded electrically to carbon steel stems and are accurately ground to size.

The pistons are cast from the same grade of metal that is used in the cylinders. They are of extra length and very accurately ground to size. Each piston is fitted with four diagonally split eccentric expansion rings. Five oil grooves are turned on the outside of the piston for collecting and distributing the oil on the inside of the cylinders.

Connecting Rods and Valves.

The connecting rods are I beam construction, made of .35 and .45 carbon steel, drop forged and heat treated, which insures great stiffness and is not subject to crystallization. The camshaft is drop forged from a single piece of low carbon steel and the cams are integral with the shaft. The shaft may be readily withdrawn in a few minutes by merely removing the gear case cover. Eight push rods of the mushroom type, made of chrome nickel steel, case hardened, with heads and stems ground to size, are operated by this shaft.

The crankshaft is carried on three bearings. It is drop forged from the same material used in the connecting rods and has a tensile strength of 90,000 pounds to the square inch. The timing gears are helical. The main and connecting rod big end bearings are made of nickel babbitt.

The clutch is a multiple disc type, with 12 plates that are operated dry. The gearset is a selective sliding gear contruction with three forward speeds and reverse. The gears are cut from nickel alloy steel, are case hardened and have ⅞-inch faces. All the gears are heat treated. Fafnir bearings are used throughout the gearset. The drive is through two Hartford universal joints and a 1¾-inch tubular shaft.

Front and Rear Axles.

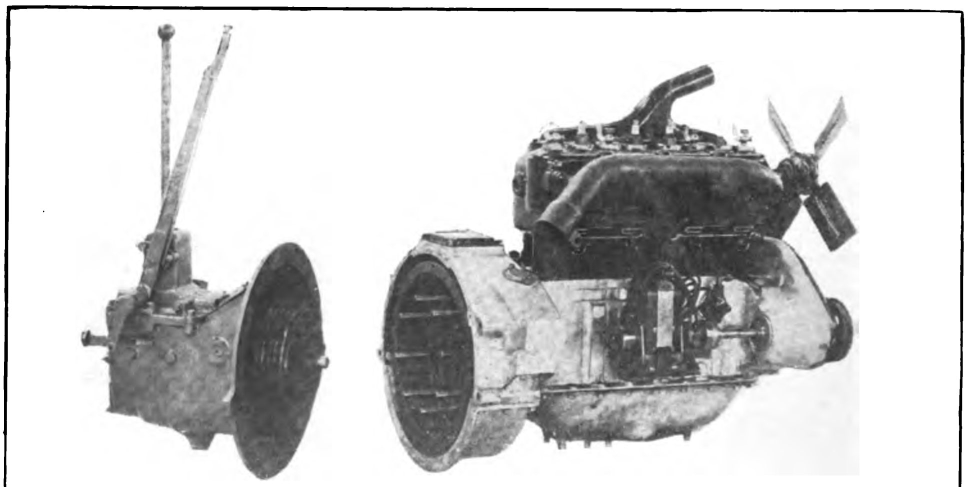
The front axle is a drop-forged steel I beam. The outside spindle bearing has a 1 1/16-inch bore by 3 3/16 outside diameter, and runs on 10 balls of ⅝ inches diameter. The inside spindle bearing has a 1 11/16 bore with an outside diameter of 4 7/32 inches, and runs on 12 balls of ¾ inches diameter.

The internal gear rear axle is fitted with nickel steel gears. The ratio of reduction is 6½ to one. The entire load is carried on a drop forged I beam. Power is transmitted through the live shafts and internal gears, which do not bear any of the weight of the truck. The inside spindle bearing on this axle has a 1¾-inch bore by 3 15/16 outside diameter. The outside spindle bearing has 1 3/16-inch bore and 2 15/16 outside diameter. Bower bearings are used in both cases.

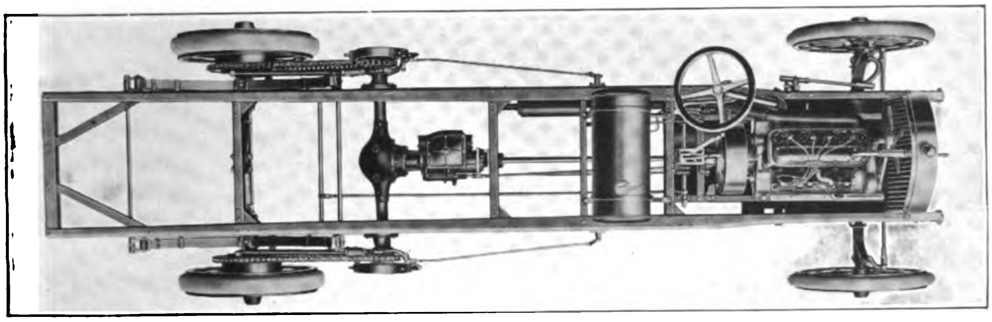
Brakes, Springs and Wheels.

Service brakes are of the external contracting type operating on drums attached to the rear wheels. The contact surface is 15 by 2½ inches. The emergency brakes are internal expanding upon rear wheel drums with 14½ by two-inch faces.

Front springs are 38 inches long by 2¼ inches wide. They have seven leaves and are single shackled at the rear. The rear springs are 44 inches long by 2¼ inches wide. These are 10 leaves, single shackled



The Continental Unit Power Plant Separated at the Bell Housing to Show the Multiple Disk Clutch.



The Plan View of the 3000-Pound Capacity Chain Driven Chassis, the Specifications of Which Generally Apply to the 2000-Pound Machine.

at the rear. Both sets of springs are semi-elliptic.

Artillery type wood wheels with 14 1¾-inch square spokes are used at both the front and the rear. The tires are Firestone. The sizes are 35 by three inches front and 35 by 3½ inches rear when of the cushion type. If pneumatic tires are desired they are furnished at an additional cost of $50, and 34 by 4½ inches front and 35 by five inches rear being used.

The steering gear is a worm and nut type and is located on the left side. The steering wheel is 18 inches in diameter.

The truck frame is 34 inches wide, but inswept to a width of 31 inches between the front wheels. It is 182 inches long and 4½ inches deep at the centre. A 3/16-inch pressed steel channel section is used. The length back of the driver's seat is 98 inches.

The wheelbase is 124 inches and the tread 56 inches. The weight of the chassis is 2800 pounds. Standard color for the chassis is yellow and the body is brewster green. The capacity of the gasoline tank is 16 gallons. The equipment includes oil, side and tail lamps, horn, tool kit, tool box, rear fenders and a flareboard express body, which measures 108 by 44 inches.

The Larger Chassis.

The 2000 and 3000-pound chassis are equipped with Continental motors which have a bore of 3¾ inches and stroke of 5¼ inches and which are equipped with water pump circulation for the cooling system and a tubular radiator. The magneto used is an Eisemann high-tension with fixed spark, and the carburetor is a Stromberg. The fuel is fed by pressure. The engine is fitted with an automatic governor which controls the volume of gas supplied.

A leather faced cone clutch with an aluminum spider and spring adjustment is used. The Covert gearset is a selective sliding gear type with three speeds forward and reverse. The gears are nickel steel with one-inch faces.

The drive is through a Russell full-floating jackshaft with the outer main bearings directly under the driving sprockets. All parts are readily accessible. Final drive is made by Diamond roller side chains ⅝ inches wide, ¾-inch rollers and 1¼-inch pitch.

Frame, Springs and Axles.

The frame is a Driggs-Seabury construction, 34 inches wide and inswept to 31 inches between the front wheels. It is 4½ inches deep at the centre and is made of 3/16-inch steel pressed into a channel section.

The front springs have eight leaves of alloy steel, single shackled at the rear with rebound bumpers; they are 36¾ inches long and 2¼ inches wide. The length of the rear springs is 46 inches, and they are 2½ wide, with 12 leaves, double shackled, and are equipped with rebound bumpers. There is a cross spring 29 inches long and 2¼ wide, with nine leaves of alloy steel. All springs are semi-elliptic.

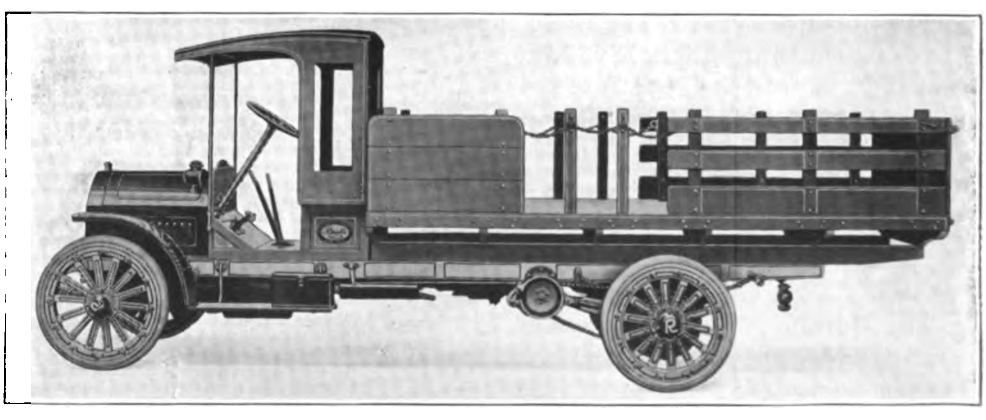
A Timken front I beam axle is used. This is 2½ inches deep and two inches wide, with ½-inch web. The outside spindle dimension for the bearing is 1⅜ inches by 1⅞ inches. The inside spindle size for bearing is 1 29/32 inches by 1⅝. Timken roller bearings are used.

The rear axle is a Walker-Weiss with a rectangular cross section 1¾ inches by three inches. The axle dimension for strut bearings is 2½ inches by 2 7/16 inches. The inside spindle dimensions for bearings is 2 5/32 inches by 2½ inches, and the outside dimensions 1 9/16 inches by 1 11/16 inches. The length of the axle overall is 68 inches. Bower bearings are used.

Steering Gear and Brakes.

The steering gear is a Lavigne construction of the worm and double sliding block type. The wheel is 18 inches in diameter. The service brakes are 10-inch external contracting on the jackshaft, and the emergency brakes are 14-inch internal expanding on rear wheel drums.

The wheels are 35 inches diameter with 14 spokes front and rear. The tires of the front wheel are 3½ inches and of the rear wheels five inches. For dual rear wheel tires an extra charge of $50 is made. The tires are Firestone solid band.



The Republic Model F Body Installed on the 3000-Pound Chassis, This Being a Standard Type Equipment.

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The chassis are made in two lengths, one having a length of 120 inches back of the driver's seat, and the other 100 inches. The wheelbase is 144 inches or 124 inches. With all equipment the weight of the chassis is 3700 pounds.

A gasoline tank of 16 gallons capacity is mounted under the driver's seat. The standard equipment includes a driver's seat and cushion, front fenders, running boards, oil dash and tail lamps, horn, tool kit and tool box.

The company has designed and can supply at reasonable rates a wide variety of bodies adapted to different services. Among the types standardized are a stake body with cab top, which may be had with or without curtains; a stake body without top, a flareboard express body, an express body with canopy top with or without curtains, a stake body with exceptionally high stakes, and a special furniture body fitted with wire gratings at the side and curtains.

PAY-ENTER 'BUSSES IN THE SOUTH.

Interest in motor passenger 'busses in its territory has led the Southern Automobile Company of Birmingham, Ala., to design a special 'bus, with an entrance near the driver's seat, for a single man operation. The chassis is 2½-ton capacity and the body is 22 feet overall, seven feet six inches wide at the roof, eight feet nine inches high and has seven inches clearance under the worm drive.

Twenty-five passengers can be carried on a single deck, all of the seats being of the transverse type except at the rear, where provision is made for the housing of the rear wheels, which projects into the passenger compartment. The door is of two-leaf design, and is operated by a crank near the driver's seat. When closed it conceals the step. The body is made of metal with ash frame. The new 'busses will be ready for the market in June.

NEW PACKARD MODELS SELL RAPIDLY.

Since the announcement, Feb. 1, of the new line of Packard trucks, manufactured by the Packard Motor Car Company, Detroit, Mich., and consisting of units ranging in capacity from one to six tons, more than $1,250,000 worth of orders have been received by the company. A remarkable feature is that a majority of the buyers had not seen anything but blue prints or advance catalogues, demonstrators having been placed in dealers' hands only recently.

'BUS LINE FOR HAVANA.

The Havana Auto Cab Company has been incorporated under the laws of Delaware for $1,000,000. The real backers of the concern are not known, as attorneys appear as incorporators. The company plans to operate omnibuses and cabs in Havana, Cuba.

WILL BUILD FOUR MODELS.

United Motor Truck Company to Manufacture Worm and Chain Types.

Production has been begun by the United Motor Truck Company of Grand Rapids, Mich., of four truck models, a two-ton worm drive, three-ton chain drive, 3½-ton worm drive and five-ton chain drive. So far as possible all parts are standard and interchangeable in all four models.

The units are made by well known specialists. The motors are a Continental product, and the other components include Timken axles, Timken-David Brown worm gears, Brown-Lipe gearsets and clutches, Perfection springs, Mayo radiators, Gemmer steering gears, Spicer universal joints, Whitney chains and Hayes bodies.

The price of the two-ton chassis is $2050, of the three-ton $2750, of the 3½-ton $2950, and of the five-ton $3400. The two-ton truck is equipped with a Continental 4⅛ by 5¼-inch engine, and the other chassis are fitted with 4½ by 5½-inch motors. The gearset and clutch are a unit with the engine and the chassis have three forward speed ratios and reverse, with centre control.

The worm axles have the overhead form of worm gearing. The springs are semi-elliptics of truck type. The front pair of the two-ton chassis is 44 inches long and 2¼ inches wide, while the rear set is three inches wide and 56 inches long. The wheelbase of the two-ton truck is 148 inches, the front tread 56 inches, and the rear tread is 58 inches. The front tires are 34 by four inches and the rear tires 36 by four-inch dual. The frame extends 120 inches behind the driver's seat.

A governor is fitted to the motor and may be adjusted to speeds of 10, 12 and 15 miles per hour. On the chain drive types the power is transmitted to a jackshaft and the final drive is through Whitney side chains. In the worm drive models the drive and torque is taken by the springs, which are so designed that under normal load they are flat.

The concern is a Michigan corporation with a capital stock of $200,000, and the officers are F. T. Hulswit, president of the Grand Rapids Street Railway and Light Company, and E. M. Elliott, secretary and general manager. The firm is now placing its dealer agencies throughout the country.

AUTOCAR REDUCES CHASSIS PRICE.

Growth of its business and improved manufacturing facilities enabling it to produce at a lower cost has resulted in another reduction in the price of the Autocar, built at Ardmore, Penn. The new price is $1650 for the chassis. This is the third reduction made by the company since Jan. 1, 1913, when its light truck sold for $2150.

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CHICAGO CONSIDERS MUNICIPAL 'BUSSES.

To remedy conditions of overcrowding on the surface and elevated lines of Chicago, a proposal has been made to establish a line of municipal 'busses. A report has been made by the commissioner of public service favoring the project, designating 12 suitable routes and estimating the probable cost of the installation. A small appropriation has been asked for additional investigation.

If the city decides to adopt the motor 'busses it will use for the purpose $3,000,000 derived from the city's share of the earnings of the traction company. Montague Ferry, the commissioner, after pointing out the advantages derived by other large cities from the use of the motor 'bus, says:

"The flexibility of motor 'bus transportation is one of its points of superiority over street car service. Motor 'busses are unhampered by ordinary blockades or by headway schedules. Their specialty in crowded traffic, such as that in London, is threading their way through the streets and leaving street cars far in the rear.

"One of the best arguments for motor 'busses is that they may be installed at once, while at the best it would be two or three years before relief could be given by the completion of subways."

1547 TRUCKS IN MICHIGAN.

The registration of motor trucks in Michigan for January and February reached 1547, of which 105 were electric and the remainder gasoline. This is practically as many as were registered during the entire year of 1914, and the registration of the next 10 months will greatly increase the figures. In the gasoline truck division the General Motors has 200, the Federal 185, the Universal 120, the International Harvester 121, while there are 51 Detroit and 22 Baker electric machines.

MOTOR TRUCK PROVES EFFICIENT.

The superiority of the motor truck used for repair work by the Worcester Consolidated Street Railway Company, Worcester, Mass., over the old-time tower car is being demonstrated daily in actual service. Recently a break happened on the Consolidated lines, and the motor truck was sent from the car barn to the scene in 23 minutes, while it would have taken the tower car at least an hour to cover the same distance.

LAVIGNE COMPANY ELECTS.

These officers have been elected by the Lavigne Manufacturing Company of Detroit for the next year: President, P. D. Dwight; vice president and general manager, N. A. Henwood; secretary and treasurer, C. J. Brumme.

GASOLINE WASTED IN HEAVY TRAFFIC.

An experiment to determine the relative amount of gasoline consumed in going a certain distance in congested traffic and the same distance on an open road has been made in Chicago with a Marmon passenger car. The result would no doubt apply equally to motor truck operation.

It showed that a trip of 10.2 miles through the congested loop district of Chicago required a gasoline consumption of 1.355 gallons, or at a rate of 7.75 miles per gallon. The car was then taken out to Grant boulevard, where the traffic is about the same as that encountered on a tour and very different results were shown.

In running 10.5 miles the car used only .666 gallons, or an average of 15.75 miles to the gallon. During the trip through the congested traffic 67 stops were necessary in compliance with the whistling of the traffic policemen or on account of the streets being blocked. During this trip the gear lever was locked in high and although there were seven passengers in the car the clutch did not slip noticeably on being dropped in.

KLAXONET MAKES SALES RECORD.

The Lovell-McConnell Manufacturing Company, Newark, N. J., states that since its announcement on March 2, orders for the new Hand Klaxonet horn have reached a daily average of 3,000. This unprecedented sale is of special significance in that it took place without any idea of what the signal would be like beyond the bare announcement that it was a Klaxton product, selling at $4 each. The signal attracted much attention at the Boston Automobile Show where it was on exhibition. The factory is stated to be working overtime on the new instrument so that deliveries may begin May 1, while the extensive advertising campaign being carried on is expected to bring in even a greater number of orders.

CONVICT-MADE TRUCKS IN OHIO.

Five motor trucks have been manufactured by the prisoners in the state penitentiary at Columbus, O. These have been delivered to various other state institutions at a cost of $2500 each. In the main the vehicles are assembled, having Continental engines and parts made by other well known specialists. The trucks were put together in the prison under the direction of a trained engineer.

Some parts, such as the muffler, frame, body, levers and upholstery, were made in the prison. It is not planned to produce trucks for sale to the public.

R. P. Spencer, one of the promoters and incorporators of the Denby Truck Company of Detroit, Mich., has withdrawn from connection with the concern.

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MECHANICAL QUERIES ANSWERED.

Natural Circulation—W. H. S., Charleston, S. C.

If you can find space in the pages of the Motor Truck, will you please explain how the water circulates in the system which is termed "natural circulation?"

A commonly known fact is that a lighter fluid will always be displaced by a heavier one, and the natural circulation of water is in accordance with this principle. When water is first placed in the system the temperature is even and there is no circulation. As the cylinders are fired heat is developed. The water in the cylinder jackets will absorb heat from the cylinders and as warm water is lighter in weight than cold water when heated, it will rise, displacing the cooler water, and entering the radiator at the top. As the radiator dissipates the heat the water will become many degrees cooler and it will fall until it becomes the coolest in the system and eventually will reach the cylinder jackets, to again be sent through the cylinders and the radiator.

This is the principle of natural circulation, and the movement will take place over and over again, keeping the temperature of the cylinders below boiling point. To insure perfect cooling efficiency the water pipes must be arranged so as to allow a perfectly free circulation. As explained above, a heavier liquid will fall and a lighter one will rise, so the velocity of the circulation will depend on the temperature. This system of circulation, although automatic, is quite slow, and, of course, will require a larger volume of water for the same size motor than would be the case if a forced circulation was employed, where the replacement of the water is very rapid.

Motor Knocks While Climbing Grades—F. L. T., Peabody, Mass.

I own a light delivery truck and of late I have been troubled with loss of power and knocking when climbing slight grades. When I examine the motor I may be able to account for the loss of power, but can you suggest what the loud knock may be?

It is the writer's opinion that you are experiencing a trouble that is very common with machines. I would advise you to inspect the cylinders for carbon deposits. As has been stated many times in these pages, carbon will become incandescent and prematurely ignite the charge of gas and cause the piston to pound. This pounding may not be heard when on a level road, as the momentum of the flywheel will be sufficient to carry the piston over centre, but when the speed is decreased, as when the car is climbing a grade, preignition is exerting an explosive force to drive the piston down before it has reached the top of the cylinder to begin its working stroke. This is true when the machine is climbing a grade with the spark advanced.

When the momentum of the flywheel is so reduced that it cannot easily carry the piston over top centre when the spark is advanced, the piston will cause a loud metallic knock and eventually will cause damage to the motor. Many times when the motor knocks on a grade the spark may be gradually retarded, and the motor will pick up in speed, as preignition cannot then take place. When the motor is cranked with the spark advanced, there may be back firing in the cylinders, which may do injury to the operator, or possibly cause broken limbs.

Overheating With Spark Retarded—J. V. R., Derby, Conn.

Being a constant reader of the Motor Truck, I would ask that you advise me through its pages as to the cause of my truck overheating. The compression is all right, as is the oiling system and water circulation. The water boils readily if the machine stands idle for a few minutes. I do not believe the carburetor is at fault, as I have tried two different makes with the same result.

From your statement I would advise you to examine the timing of the motor. If the ignition spark is occurring late in the cylinders you will undoubtedly be troubled with overheating. A late spark will overheat the motor in the following manner: The charge is fired after the piston has started on its downward stroke and burns for the entire length of the working stroke and during the exhaust stroke, so that the cylinder is not free from combustion until another charge is about to be drawn in, and many times a hard knock will be heard.

When the spark lever is fully retarded the combustion in the cylinder should occur a few degrees after the piston has passed dead centre, on its expansion stroke. This condition is intended to prevent backfiring when starting the motor. When the lever is advanced of course the firing will take place earlier and ignite the gas before the piston has reached top centre. Of course the momentum of the flywheel will carry the piston to top centre, at which point the expansion of the gas will be complete, and the explosion will easily carry the piston down. When the gas is fully burned on the explosion stroke there is a free exhaust and the hot gases can escape and allow the cylinder a cooling interval before it is charged with cool fresh gas.

Many times overheating is caused by one or more cylinders firing irregularly. When the charge has not been consumed the gas is forced into the muffler, where it will be ignited by the hot exhaust of a firing cylinder. This is termed "back firing in the muffler" and causes back pressure on the working cylinders.

I would advise you to test the timing by removing one of the spark plugs and opening all the petcocks on the cylinder head. Place a wire or piece of stick through the plug hole until it touches the piston head. Next retard the spark fully and switch on the battery and turn the motor over very slowly. When the piston has reached the height of its stroke, as will be indicated by the stick, or wire, the motor should be turned a little more until the piston starts on its downward stroke, at which point the commutator points should be made to contact. This condition can be ascertained by grounding the spark plug to the cylinder. This is the lowest point at which the motor should fire.

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SERVICE FOR PIERCE-ARROW TRUCK OWNERS.

Foss-Hughes Company, Philadelphia Distributor, Maintains Large Special Equipment to Turn Out Work Quickly and Do It with Factory Efficiency and Finish.

IN THE business of marketing motor trucks there is no problem of more interest and importance to the dealer, the manufacturer and the buyer than the establishment of a standard of "service" which shall be generally accepted as just and sufficient by all directly concerned, as well as by those who may be interested in power vehicle transportation.

There has in the past been so much variance in the meaning of the terms "service" that a buyer may have been doubtful as to just what he might expect after the purchase of a truck, and the dealer and maker on the other hand have been equally uncertain as to what they ought to include in the term as applied to their own transactions.

Whatever the standard is to be it must be such as will accomplish two results: It must enable the buyer to operate his truck at a profit to himself and at a reasonable expense for up-keep and repairs, and it must not be so expensive to the dealer and manufacturer that it eats up the profit to which they are justly entitled for the sale of a truck.

In the past, owing to absence of definite standards, service as given by the distributors has erred in both directions—sometimes leaving the buyer too much to his own resources, and without the guidance which can only be given by some one with a thorough technical knowledge of his truck and an interest in its successful operation; sometimes also the buyer has received in replacement of parts and free repairs more than he could justly expect, and more than the dealer could afford to give if he is to remain in business.

It was for the purpose of making clear just what the leading makers of trucks are doing in the way of service for the users of machines they build that the present series of articles was undertaken by the MOTOR TRUCK.

The Foss-Hughes Company, Pierce-Arrow distributor in Philadelphia, Penn., where it operates a very large and exceptionally well equipped service plant, is an example of a truck selling concern that has solved the service problem and has established relations with its patrons which are very satisfactory.

The firm keeps the trucks of its patrons in as near as is possible continuous operation, wins the enthusiastic loyalty of purchasers of the product it represents, and yet secures a reasonable return on labor and material used in all repair work.

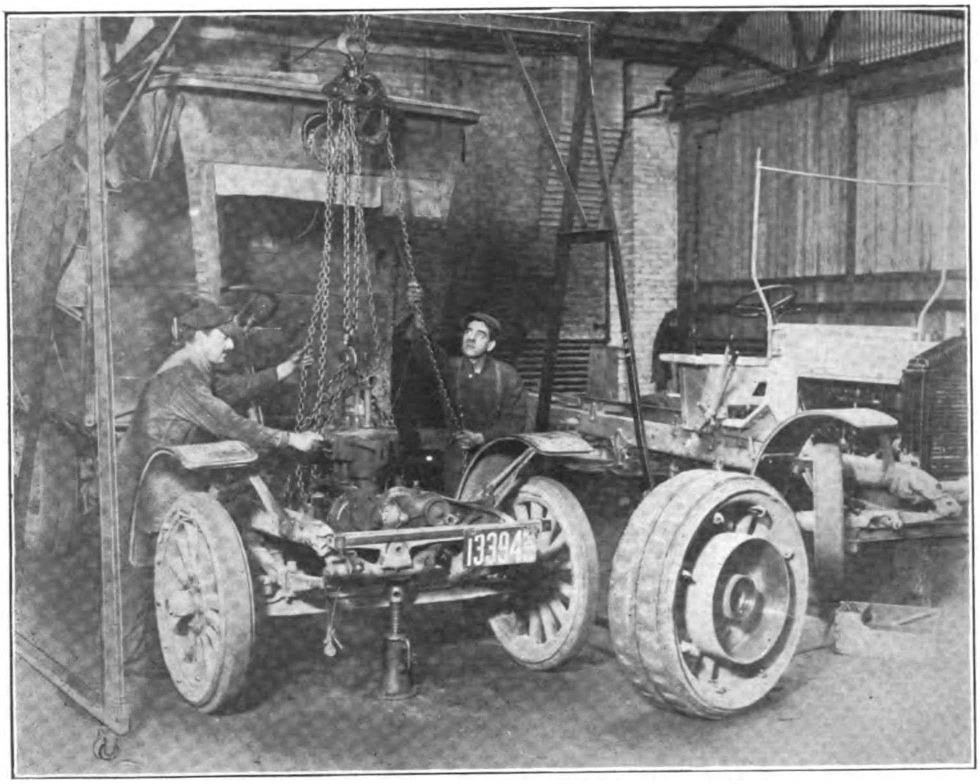
To describe the system in a few words, it might be said that the Foss-Hughes Company supplies, through a thoroughly trained service specialist, technical and mechanical knowledge of the best methods of operating and repairing Pierce-Arrow trucks, while it depends upon the owner to supply all material and labor necessary for maintenance—except in the rare cases where material or workmanship upon the truck are shown to have been faulty.

The Foss-Hughes Building at 21st and Market Streets, Philadelphia.

When repair work is necessary everything helpful has been provided to turn it out quickly, and to make sure that the work will be of the highest quality. The best obtainable labor is employed and the same men are kept year after year; a large investment has been made in special power driven tools, and thousands of small tools and jigs designed especially for Pierce-Arrow work are kept on hand. Much initiative has been used in working out shop systems, with the result that they differ in many particulars from those ordinarily employed.

Men Trained to Drive Trucks.

When a Pierce-Arrow truck is purchased and a driver for it selected, the Foss-Hughes Company does not insist that a trained mechanic be employed to drive it. If the owner has men in his employ who are familiar with his delivery system whom he wishes to



Lifting a Motor from a Chassis in the Truck Repair Department.

operate the machine, the company undertakes by a course of instruction by its service expert to train the driver to handle the truck satisfactorily in from 10 days to two weeks.

The service expert is selected not only with a view of his technical knowledge of the Pierce-Arrow truck, but also to secure a personality that will lead to the friendliest relations between the owner and the driver of the truck and the Foss-Hughes Company.

After the driver's instruction is finished and the truck is left in his care, he is visited frequently for a short period by the service man, who observes the condition of the truck and keeps the man instructed regarding necessary care and attention. It is a principle with the company to make every effort to have the truck kept in good condition by appealing direct to the driver. A complaint concerning the driver's work is never carried to his employer until every effort has been made to secure the correction of the condition by direct work with the man, unless serious damage is being done to the truck.

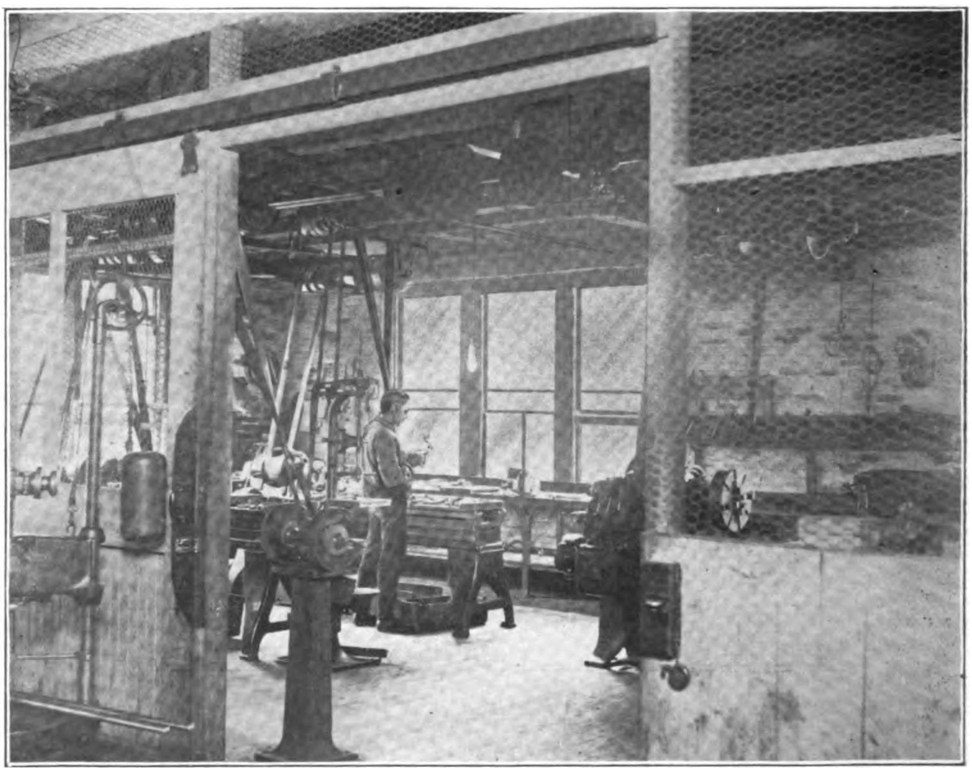
Duties of the Service Man.

The service man can always be had on an emergency call to oversee any repair that may be under way in an owner's garage if the work and the means of doing it are not thoroughly understood by the men there. Many of the larger users of Pierce-Arrow trucks in Philadelphia are installing shops of their own and the Foss-Hughes service department is of great assistance in the organization of these shops, in the instruction in Pierce-Arrow methods of the men employed, or in the solution of any especially difficult problem that may come up in the course of maintenance work.

When not employed on emergency calls the service man makes regular rounds, visiting every truck sold by the company at intervals of from two to four weeks. On these occasions he inspects the truck, recommends necessary repair work and executes minor adjustments.

Following the Service Calls.

Owners are not encouraged to bring their trucks into the service station for inspection. One of the duties of the service man is to keep all trucks out of the shop unless the conditions to be dealt with requires repair work that cannot be dealt with with the facilities possessed by the owners. An ingenious sys-



The Machine Tool Room, on the Third Floor of the Building.

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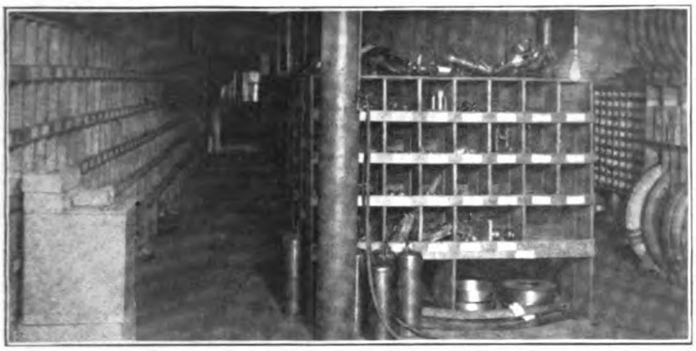


Stock Room Where Supplies of Spare Parts Are Kept; Replacements for All Pierce-Arrow Models Are Available.

tem is used to keep constantly in touch with the service man, who travels from one truck installation to another on a motorcycle. In the truck department of the Foss-Hughes company's station is kept a rack of cards printed on yellow board. Each of these cards bear the name of a truck owner and numbers representing the hours from 7 a. m. to 5 p. m. When the service man makes a call on an owner he telephones the truck department and a spring clip with a blue enamelled top is fastened to that owner's card on the rack at the number indicating the hour when the service man arrived there.

If there is need to call the service man at any time a glance at the rack will show the blue clip and indicates instantly where he is and how long he has been there. If an emergency call is answered a red instead of a blue clip is used to mark the service man's whereabouts. And after he has left a yellow slip is attached to the owner's card, to remain there until the end of the month.

If the number of emergency calls for any one owner is shown at the end of the month to be unreasonably large, an investigation is made of his truck and of conditions at his garage and an effort is made to eliminate the cause of them.

System Minimizes Repairs.

The work of this service expert is designed to cut down the repairs necessary on trucks, and it has resulted in a reduction of the amount of shop work done by the company to a surprising low ratio. Trucks frequently are brought in for their first overhaul after being driven from 25,000 to 35,000 miles.

When overhauling or extended repairs are necessary the owner can be furnished either a five-ton or a two-ton machine to take care of his work while his truck is in the shop. For this service he is charged at a daily rate equal to the amount he was told by the truck department that his own truck would cost him when he bought it.

If wheels, radiators or other parts are temporarily installed on a truck for use while repairs are made to regular equipment, these are charged for at rates determined on the average depreciation of the parts. For an extra wheel with a tire the charge may go to several dollars a day; for a radiator it will be a few cents.

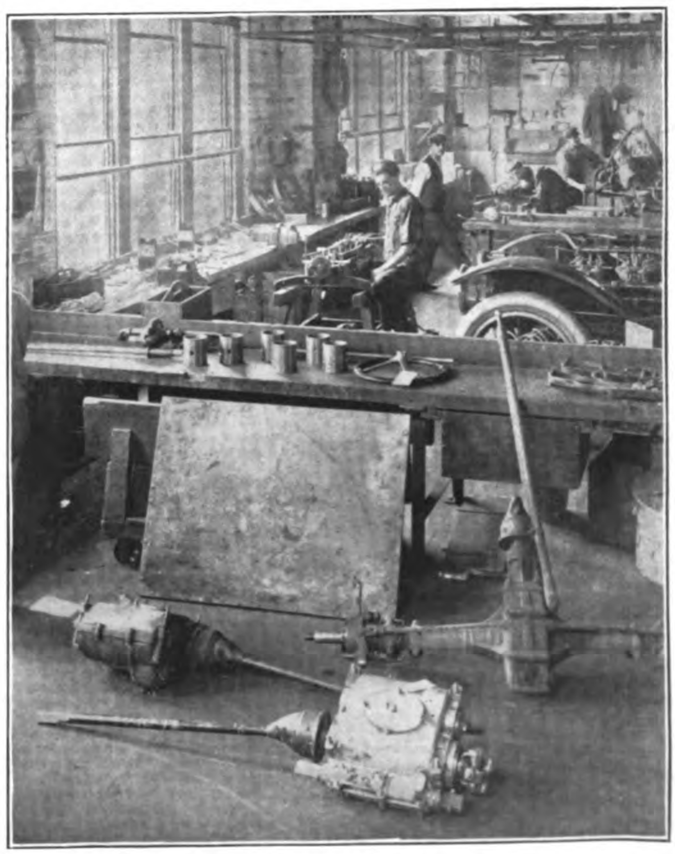
When a truck is brought into the Foss-Hughes station for repairs, it is thoroughly inspected by the chief of the mechanical department, a list is made of the work upon it that is desirable, which is submitted to the owner for approval, and then endeavor is made to get the machine out of the shop quickly, with the job completed to the standard of the company.

Although the great majority of service stations and garages in Philadelphia charge 60 cents an hour for the labor of a mechanic, the Foss-Hughes Company charges 90 cents an hour for mechanical work, and 60 cents for a helper, and employs as few helpers as is possible. The average cost to the owner of all the labor employed on his machine is about 84 cents an hour, including both helpers and mechanics.

The company admits that it often has complaints from new owners regarding this seemingly high price for labor, and that for a time work is occasionally taken elsewhere, but almost invariably it returns. It took much foresight and some boldness to establish the 90-cent rate when the prevailing standard was 60 cents, but being accustomed to selling things on a quality and not a price basis, the concern took the step and it has worked out splendidly, for both the owner and the dealer.

How Labor Is Economized.

The fact is that the large investment of the company in special tools, such, for instance, as portable grinders, or a large solder bath in which an entire radiator can be dipped at once, makes it possible to save a great deal of time that would otherwise be neces-



The Motor Room, in Which Work for Both Trucks and Passenger Cars Is Done.

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FOSS-HUGHES COMPANY
21st and Market Streets

TRUCK DEPARTMENT **Date**

Owner

INSPECTOR'S REPORT

Grease Cups

Care of Car

MOTOR . . . { Oiling System, Carburetter, Valves, Governor, Ignition, Radiator, Water Pump, Fan

CLUTCH . . .

TRANSMISSION { Grease Level, Gears, Shafts, Shifting Levers, Grease Retainers

STEERING ARRANGEMENT { Steering Gear, Coupling Rods, Steering Knuckles

BRAKES . . . { Hand Brake, Foot Brake

UNIVERSALS . {

SHAFTS . . . { Driving Shafts, Torsion Rod, Radius Rods

RUNNING GEAR { Frame, Front axle, " springs, " spring hangers, " wheels, " wheel tires, Rear axle, " springs, " spring hangers, " wheels, " wheel tires, Worm Gear, Worm Gear Oil Level

BODY . . .
LOOSE BOLTS
MILEAGE . .
REMARKS . .

Inspector's Report, Printed in Duplicate in Different Colors—Size, 9½ by 12 Inches.

sary were the equipment less complete. On many jobs one man at 90 cents can do as much work in an hour as two or three at 60 without equal facilities.

So while the hour rate looks large on the owner's bill, the total expense of an overhaul is frequently less than similar work would cost in other shops. And, of course, this work is of high quality. Often owners who have taken their work to other shops return upon learning the economy of Foss-Hughes methods, and from their experiences the Foss-Hughes Company has compiled a table of average charges for certain specific jobs in its own shops and those of other service stations where the 60-cent rate prevails, and it uses this table effectively to arrest complaints on its 90-cent rate for labor.

All work done on a truck or passenger car in the Foss-Hughes shops is analyzed and divided up on the cost sheet—illustrated in this article—into 10 divisions shown on the sheet in columns headed A, B, C, D, E, F, Q, X, Z, G. A refers to work and material used on the motor, B on the transmission, C the rear axle, D the steering column, E the electric system, F the fenders and radiator, Q the general overhauling, X the finishing and testing, Z the painting and G the outside work and accessories.

On the time card, which is illustrated, the workman "punches in" on a clock the hour at which he begins a job and the hour at which he finishes it. This, of course, supplies both a check on the workman and evidence for the customer of work done. The items on the workman's time card are entered with date, in the column on the cost sheet, which is devoted to motor, or transmission, or rear axle as the case may be. This supplies a record from which it is possible to determine at any later time just who in the shop executed any work on the truck that may be found to be defective.

The lower half of the cost sheet is divided for the same departments and is given over to the material used on the job. This part of the cost sheet is made up from the requisitions. These requisitions are made out by the foreman in duplicate, sent to the repair clerk for "O. K.," and then taken to the stock department. For each of the 10 departments already mentioned there is a different colored requisition, so only a glance at the paper shows to what use any material mentioned is put. The cost sheet is made out in triplicate, one copy going to the truck owner, another to the accounting department for billing purposes and a third is kept on file.

Repair Job No.

Owner

Address

To be ready

INSTRUCTIONS FOR SHOP AND GARAGE MEN
For Delivery of Car to Owner or Driver After Work is Completed.

Tag of Instructions Regarding Delivery of Finished Car; Size 6¼ by 3½ Inches.

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REQUISITION

(In color of Department and to be used for Stock parts or work done in another Department for the Department issuing requisition.)

To be made in duplicate and sent to Repair time clerk to be Ok'd.

Repair Order 4370

Dept. ______

Requisition; Printed in Duplicate and in Different Colors for Each Department; Size Eight by Five Inches.

About a year ago Mr. Hughes discovered that with this cost system it was costing the company about 2½ cents for clerical work and material every time a charge was entered against a customer. In the case of very small parts like cotter pins, or keys or nuts and bolts, billed to the customer at from one cent to five or six cents, this was highly unprofitable.

So boxes of these small parts were placed in the shops where the workmen can use as many as are needed without issuing requisitions. To cover the cost of these small parts an arbitrary charge of five per cent. is added to the total cost of material on every job. This has been found in practise to recompense the company fully for the small parts and to result in a close approximation of the charges made when they were entered on the bill. When the reasons for the charge are explained to customers they seldom object.

A similar arbitrary charge of five per cent. is added also to the bill for labor. Owing to the cost of operating its large special tool equipment, such as its system of compressed air all over the building, portable grinders, hot riveting machines, aligning bars to true crankshafts, double-end reamers, etc., the company was not really making satisfactory margin on labor charged at 90 cents an hour.

Therefore, the extra charge of five per cent. for labor was adopted to cover the following items: Depreciation on $8000 worth of special machinery at 15 per cent., $1205 a year; replacement of small tools, $1200 a year; electricity for power, $600 a year; gas, $420; oxygen, $120; coal for forge, $18. These items, spread over the labor bills of the company for a year, amount to approximately five per cent. When the basis of the charge is explained the company's customers realize that it is reasonable and that with it the company can keep its equipment in perfect shape, to their own advantage when they need service.

How the Plant Is Operated.

The plant of the Foss-Hughes Company is a handsome building at 21st and Market streets, Philadelphia. Formerly the station was located in North Broad street, but when expansion became imperative the company took a step which has since been followed by a number of large Philadelphia distributors, and moved toward the Schuylkill river.

The present plant is as large as a fair sized factory. It occupies a total of 56,000 square feet of floor space, or about an acre and a quarter. This is divided as follows: 3600 feet for the sale of new cars; 8729 feet for the garage, 2400 feet for the truck repair shop, 2000 feet for second-hand car sales, 3182 feet for the offices and stock rooms, 8200 feet for the storage rooms, 13,380 feet for the shop proper, 11,190 feet for the paint shop and 2190 feet for the upholstery shop.

The sales rooms and the desks of the passenger car salesmen are on the first floor. This room is tastefully and neatly decorated and furnished, and with the uniformed man at the door it affords the atmosphere that is traditional in places where $5000 cars are sold. It has not the display of marble and mahogany

TIME		ELAPSED TIME	JOB. NO.	DEPT.			OPERATION.
	FINISH						
	START						
	FINISH						
	START						
	FINISH						
	START						
	FINISH						
	START						
	FINISH						
	START						
	FINISH						
	START						
Total Time							
Checked With Time Card							
Checked by Foreman							

Name

No.

FOSS-HUGHES COMPANY
21st and Market Streets
PHILADELPHIA

Workman's Time Card; Size 8½ by Four Inches; Punched at Beginning and End of Job.

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Job No. C		Car Rec'd ·	
Name		Job Finished	
Address		Odometer	Miles
Make of Car	No.	Speedometer	Miles
			Stock No.

Charge To	Instructions
Charges and Credits Not Entered	
Req. / Chg.	
"	
"	
"	

One Side of the Repair Cost Sheet; Printed in Triplicate; Size Approximately 9½ by 14 Inches.

that was once regarded as being essential for impressing the purchasers of high priced cars, but it gives the visitor an impression that here the relation of overhead expense to the profitable management of a motor car business has been well studied.

The space about the room is given over to the display of Peirce-Arrow cars, which are visible also from the street through the plate glass which, with a few pillars, forms the sides of the building.

The Mechanical Departments.

Just behind the sales rooms is an elevator by which passenger cars or trucks bound for the painting or other upstairs departments can be lifted. Entrance to this elevator may be had from either the street or the garage. The garage, with the truck shops, occupies most of the remaining space on the first floor.

The shop is at the back of the garage and affords working space for four or five trucks at a time. Here when repairs are necessary the truck is run and such disassembling as may be necessary takes place. The motors are lifted from the chassis by a portable crane, such as is shown in one of the illustrations of this article.

Such parts as need attention are then taken upstairs to the main shops, where a special department is operated for each important unit. These departments, which have been previously enumerated in connection with the discussion of the cost sheet, have several advantages. The first and most important is that they develop specialists in the various process of truck repair. That is, one group of men works constantly on transmission gear-sets, others on motors, rear axles, etc. The workmen naturally become very proficient.

Each department has its own head, under the general superintendent, and supervision of the work is very close. The division of the work also makes the placing of responsibility much surer than in a shop where everybody works on everything. In fact, with the aid of the repair cost sheet the Foss-Hughes Company can determine months after a job has gone out just who was responsible for certain work upon it.

On the second floor are the offices of the company. Here again the equipment is in every way consistent with the dignity that any business need maintain and still keep away from any appearance of extravagance. In the corner of the floor, which is directly over the passenger car sales room below, the used cars marketed by the company are displayed, and the offices of the used car salesmen are maintained.

At the rear of this room is another office set off by partitions where the truck department has its head-

DATE	WORKMAN	A	B	C	D	E	F	Q	X	Z	G
		M H	M H	M H	M H	M H	M H	M H	M H	M H	M H
	TOTAL LABOR										

DATE	DESCRIPTION	A	B	C	D	E	F	Q	X	Z	
	TOTAL MATERIAL										

TOTAL	OUTSIDE WORK & ACCESSORIES	MATERIAL	TOTAL LABOR	G	Z	X	Q	F	E	D	C	B	A	DEPT.
														HOURS
														LABOR
														PART

Reverse of Cost Sheet; On This Side Time and Material Items and Totals Are Entered.

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quarters. The head of the department, who is responsible for both sales and service, has ample provision for his salesmen and such clerks and stenographers as are required to carry on the work of the department.

The main shops are on the third floor and the painting and upholstery is done on the fourth. Outside of the passenger car salesroom, which occupies the choicest section, the street level floor is given up to sales rooms of other makes of cars. All the rest of the building is taken up by the requirements of the Foss-Hughes business.

Just behind the building are the main line tracks of the Pennsylvania railroad entering Philadelphia. Over these every day 60,000 people are said to pass and the Foss-Hughes Company has taken advantage of this potential publicity to the fullest extent by the use of electrical and other signs.

ELECTRIC TAXI TRIED IN NEW YORK.

The New York Central Railway and Grand Central Terminal interests have been trying to develop a successful electric taxicab and one has been under test for some time which is said to fill the requirements set for such a vehicle.

Service tests have been made in which various electrics have been operated along side the gasoline cabs of the Westcott Express Company and the results are said to have been very favorable. It has been found that a large part of the public prefers to ride in the electric.

One of the cabs tested is a landaulet, built by the Rauch & Lang Carriage Company of Cleveland, O. It is fitted with a special body with provision for carrying luggage and the interior is attractively equipped. It was operated for three months last summer and put in service again in December for a test under winter conditions. While in the service it has been driven an average of 70 miles per day.

Different batteries were used in the car and it was run part of the time on cushion and part of the time on pneumatic tires.

JOINS CHASE TRUCK COMPANY.

H. D. Andress, who has been employed as a transportation expert by the Pennsylvania Railroad Company, has been appointed a division manager by the Chase Motor Truck Company of Syracuse, N. Y. His territory includes Ohio, Indiana, Kentucky and part of West Virginia.

The Four-Wheel Drive Automobile Company of Clintonville, Wis., is looking for a site on which to build another automobile plant. Large orders of government trucks are given as the reason for the expansion at this time.

MASSACHUSETTS MOTOR LEGISLATION.

Bills of interest to motorists generally were discussed in hearings before the committee on roads and bridges in the State House, Boston, Mass. They were mostly in the nature of amendments intended to perfect the statutes effecting motor vehicles, including motor bicycles, police and fire patrols. The most important was the bill to extend the control of the highway commission, of which Col. William D. Sohier is chairman, over persons who, under the law, if accompanied by a licensed chauffeur, can operate without a license. Col. Sohier explained that the commission has power to prevent non-residents from operating if it thinks them unfitted; but it can only blacklist others who have no Massachusetts license and the blacklist is not effective until an application for a license is received.

Another reform proposed tends toward lowering the cost of chauffeurs' licenses. To meet a supreme court decision, Col. Sohier said, it is necessary that a man operating his own car for hire shall have a chauffeur's license. The commission will give a chauffeur's license to an experienced operator of this kind without extra cost. The change was favored by the Massachusetts State Automobile Association, the Automobile Legal Association and other motoring organizations.

All the bills recommended by the highway commission were later reported favorably and filed in the House. They included recommendations to classify motorcycles as motor vehicles, and to require the registration of operators of ambulances.

OGDEN, U., TO MOTORIZE FIRE SERVICE.

Three motors have already been purchased by the city of Ogden, Utah, for its fire department, and the complete motorization of the service is expected to be accomplished in three years. The first purchases will be a combination hose and chemical and a tractor to draw a hook-and-ladder truck.

NEW KOEHLER AGENCIES.

The following truck agencies have been made for the H. J. Koehler S. G. Company, Newark, N. J.: George R. Beeson, Connorsville, Ind.; Ford Auto Company, Wilmington, N. C.; D. H. Gaskins, New Bern, N. C., and the John Christensen & Co., Galveston, Tex.

MASSACHUSETTS TRUCKS INCREASE.

The first three months' registration in Massachusetts shows an increase of the number of motor trucks of from 5200 last year to 7800 in 1915. The total registration for 1914 was 8236, but the indications are that this figure will be greatly exceeded.

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PRACTICAL MOTOR TRUCK MECHANICS.

A MISTAKE quite frequently made by owners who do their own repairing, is the replacement of a connecting rod without using enough shims. A great deal of scraping is necessary to perfectly fit a new bearing, and not infrequently a bearing is passed at inspection if it bears for the greater part of its length. If there are high places on the bearing the crankshaft will soon wear them off and, of course, leave the rod loose. If the bearing is not adjusted damage to the motor may result.

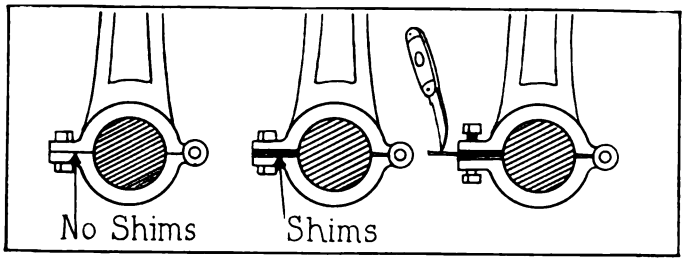

Fig. 1—A Connecting Rod Without Shims, a Bearing Rightly Shimmed, and the Manner of Removing Shims with a Pocket-knife.

If the rod has been properly shimmed it may be tightened by reducing the number of shims. When no shims or an inadequate number have been used, the only remedy left is to file the lips of the bearing. Nine times out of 10 this will necessitate removing the rod from the cylinder, which will require quite a little time. It is a great deal the better policy to file the lips of the bearing before installing the rod and close the space by the use of shims. When the rod commences to wear the play may be taken up by loosening the bolts and removing a few thin shims. This can best be done with an ordinary pen knife. A new connecting rod should never be installed under any circumstances unless at least 10 shims are used to make it fit.

At Fig. 1 is shown several examples of fitting and adjusting connecting rods, one of these being without and another with shims, as well as a suggestion for removing a shim with the blade of a pocket knife when adjusting a bearing.

EXTRICATING A STALLED TRUCK.

Quite as numerous as the causes for the loss of traction and the stalling of trucks are the means resorted to by clever drivers for extricating their machines. When an unloaded truck goes into a ditch, a mud hole, or becomes sunken in sand, the situation is no joke, but when a vehicle is loaded and the freight must be removed before the machine can be moved the driver cannot be blamed for endeavoring to minimize his own labor so far as is possible. Frequently blocking has been found necessary, or jacking and filling the hole or the ditch beneath the wheel, or brush may be cut and worked under the tire.

Many times traction may be regained by placing a piece of burlap or a board under the wheel and starting the engine slowly. If the wheel has sunk into deep mud or is on a very icy surface, these means may not be practical, as there will be no firm foundation and the burlap or board will be carried backward by the revolving wheel.

The following method, which is illustrated in Fig. 2, will be found positive under all conditions and will never fail to extricate the truck. Take a good size rope or chain, which are generally carried on a truck, and fasten one end of it to any convenient post or tree. If no tree or post is available a stake may be driven solidly into the ground. After making one end secure, the other end should be passed under the wheel and then over the top and under the bottom for the second time, following the channel between the dual tire. After having formed the loop around the wheel the free end should be held tightly by one man. When the engine is started slowly the wheel will wind the rope or chain as if it were a drum and pull the machine ahead. The lead of the rope ought to be placed at such an angle that the truck will move toward a surface where traction can be obtained. The use of a jack may be necessary to get the rope or chain under the wheel. Incidentally a section of wire cable, about 100 feet long, with a hook spliced into each end, is a very desirable equipment for any truck, especially if the trips are of considerable length.

CARE OF TRUCK CHAINS.

If the chains of a truck are given the right kind of care they will no doubt afford satisfactory service to the owner. Chains should not be allowed to run too slack, neither should the radius of one rear wheel be greater than the other, as the sharp edges of the sprocket will cut the rolls. Each morning the chains should be well lubricated and once a week they should be removed and allowed to remain in kerosene for a few hours at least. This will remove all the dirt and grit and leave the rolls so that they may move freely. If a roll should break do not allow the link to remain in that condition, as it will weaken that section of the chain and cause other rolls to break. Occasionally the

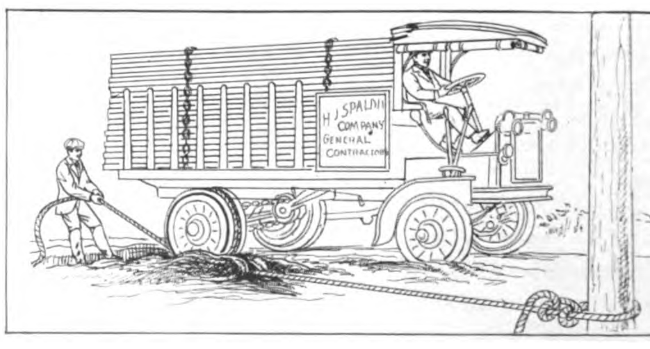

Fig. 2—Drawing a Truck from a Mud Hole by the Use of a Rope Wound Around the Wheel That Has Lost Traction.

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sprockets should be examined to see if there are any sharp edges. If any are found they should be removed by filing slowly with a coarse file. Sprockets are gen-

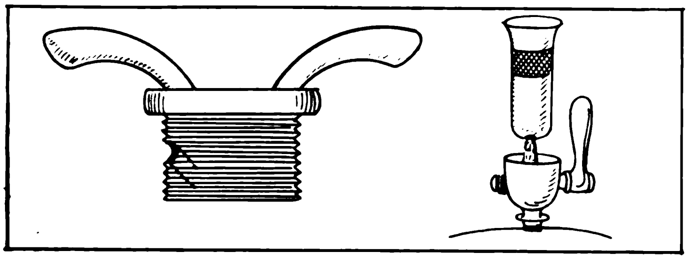

Fig. 3—Vent Cut in Gasoline Tank Filler Cap to Release Pressure, and Primer Made from a Tire Tube Dust Cap.

erally hardened, but by applying the file very slowly and firmly the edges can be removed.

GASOLINE TANK PRESSURE RELEASE.

In many trucks, which have been converted from pleasure cars, the gasoline is fed to the carburetor by pressure. On many older machines the gasoline tank must have considerable pressure to insure a certain flow of the fuel. Quite frequently no provision is made for reducing this pressure when the tank is to be refilled, and if care is not taken when removing the cover it will be thrown so violently as to injure the operator, or it will at least require time in finding it. A simple insurance against any such happening is to drill a small hole in the threads of the cap, as shown in Fig. 3 A. When this cap is in position it will be absolutely air tight, but when it is to be removed the air will escape through the hole before the cap becomes detached from the tank.

HANDY MOTOR PRIMER.

A handy motor primer can be made from a tire valve dust cap. A small hole should be drilled at the end of the cap so that the gasoline can be fed to the priming cock on the cylinder. By placing the finger over the opening of the cap it can be handled anywhere, as the gasoline cannot escape. The drilled hole will not impair the use of the cap on a valve, and can be used as such when not required as a primer. Fig. 3 B illustrates the primer when priming an engine.

CLEANING PLATINUM POINTS.

The efficiency of the spark coil of the vibrating type depends largely upon the condition of the platinum points of the adjusting screw and trembler blade. If these become burned or pitted, more current will be required to overcome the resistance, and often their condition is such that the operation of the motor is considerably affected. Some points pit more easily than others, which may be due to poor adjustment or impure metal. The usual manner of cleaning the contacts is to remove the screw and blade and with a fine file smooth the surface so as to eliminate the pit holes and make the metal true and even.

Fig. 4 A illustrates a simple method of cleaning the points without changing the adjustment, which is necessary when the blade and screw are removed. A strip of fine emery cloth is placed between the contact points and the trembler blade raised until a slight pressure is brought to bear against the emery surface, which is then moved back and forth, taking care to keep it perfectly horizontal. After cleaning the adjusting screw the paper is reversed and the operation repeated. This will smooth the points and they will be left perfectly true. Contacts that are filed true may be aligned in this manner, which is applicable to similar parts, such as the contacts of a magneto, or the anvils and hammers of the make and break ignition.

RADIATOR CAP SAFETY DEVICE.

Radiator caps sometimes work loose, due to their not being screwed on tightly when replacing them. As the caps are invariably lost on the road they are seldom if ever recovered, in which event the filler can be closed by tying a piece of chamois over it. A cap fastener which can be quickly and easily made is illustrated in Fig. 4 B. It consists of a section of chain soldered to the cap at one end and attached to a bar longer than the diameter of the radiator filler at the other end.

The length of the bar should be slightly less than the inside width of the radiator, so that the car can turn when the cap is screwed on or off. Fig. 4 C illustrates a cap which has worked loose, but is prevented from becoming lost by the chain attachment.

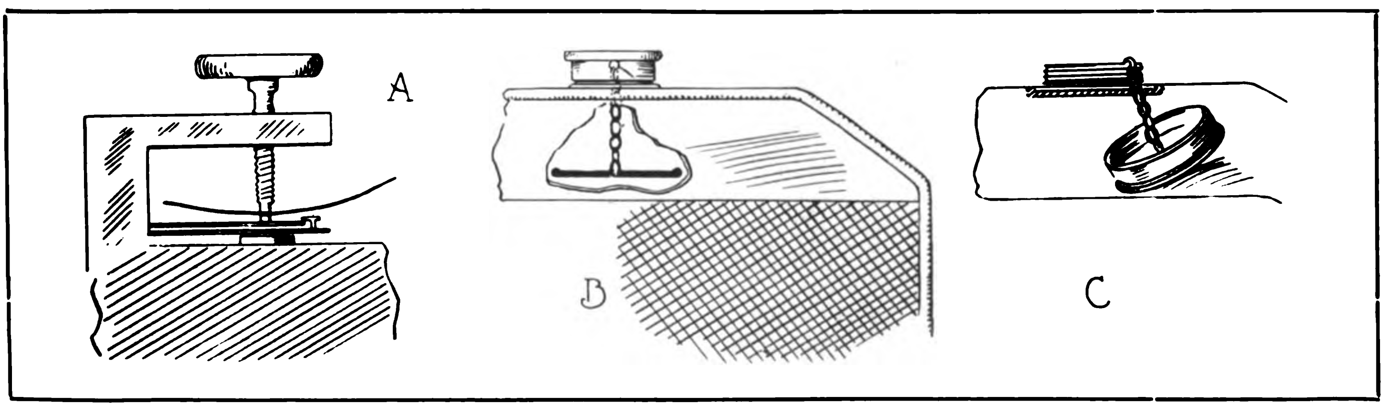

Fig. 4—A, Cleaning the Platinum Points of a Vibrator; B, Stop to Prevent Loss of Radiator Cap; C, the Practical Utility of the Stop.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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THE PROBLEM OF THE "JITNEY."

The fact that practically all the vehicles used for "jitney" service are pleasure cars, generally light, designed for small loads and for speed, and not intended for economy of fuel, lubricant, tires or maintenance, means that while these may serve for a time for the work, they must eventually be replaced by machines that are constructed with special reference to the uses to be made of them. Operating economy must be the one object sought in the design that will be practical in "jitney" work, and this must be regarded from all angles. The machine must have sufficient carrying capacity and protection to recommend it. Appearance is secondary, although this should not be sacrificed. No individual can engage in this development from prevailing types, for this is an undertaking for the engineer and then for the manufacturer. The people demand the "jitney" service, but those operating vehicles, either individuals or corporations, must have equipment that will be profitable, and this can only come from the industry.

HIGHWAYS FOR MOTOR VEHICLE TRAFFIC.

No one questions the necessity of the motor vehicle. The numbers in use are increasing each year. The highway that would endure under slow moving and limited traffic will wear proportionately as traffic increases in volume and speed. The public pays the taxes and seemingly does not understand that a road or street must be maintained at expense in ratio to the use made of it. A political expedient has been to tax motor vehicle and exempt horse drawn conveyances. The highway that will longest endure under animal vehicles will wear more quickly under motor cars and trucks, and that which will afford the greatest service with automobile transports will soon yield to animal traffic.

Obviously, two classifications of roads would meet this condition, but to construct these is impossible because of expense. The alternative is the roadway that will not greatly wear under any type of vehicle, and this means a surface that will be smooth, hard and enduring. Engineers are not agreed to any particular construction. Experiment requires time and costs money. Each year more work is necessary to keep the highways in passable condition, and with the increasing construction cost the demands for money are very large. Money must be spent on the highways, but practically all expenditures are for work that will not endure. Evidently one of the greatest public problems is to build enduring roads—not to devise means of taxation to continue to construct highways that will always be expensive to maintain and costly for those who operate vehicles on them.

POSSIBILITIES OF FUEL ECONOMY.

European motor vehicle engineers have given much attention to the economy of fuel, a very natural purpose when one understands that the cost of gasoline is from four to 10 times the prices that obtain in America, and while they have sought to improve carburetion, they have also used smaller engines and very frequently a four ratio transmission gearset. Within a very short time attention has been directed to the production of benzol in this country as a by-product of coke manufacture, and large claims are made for the possibilities with this hydrocarbon, but there is little probability that this will be a factor of importance because of the small quantity that can be produced. Kerosene and distillate are practical fuels, but better or different carburetors are necessary to afford the same convenience that obtains with gasoline. What is really needed is careful development of means of burning these fuels. This accomplished, there will be no cause for apprehension of excessive cost, for both kerosene and other oils now available will be sufficient for all needs for a long period of time.

MOTOR TRUCK CONVENTION.

The convention of motor truck manufacturers to be held at Detroit early in May ought to be productive of extremely beneficial results. It will be open to all builders of machines and the purpose is to consider subjects that are of material interest, which involve manufacturing, selling and service, and the desire of the promoters is to determine policies which will be recommended for adoption, and which will be equitable to the industry and those who use motor vehicles.

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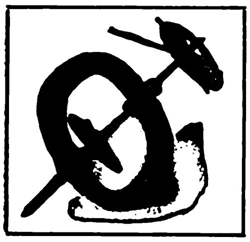
ELECTRIC VEHICLE PRACTISE.

Instruments for Measuring the Pressure and Quantity of Current—Principles of Design and Construction of Voltmeters and Ammeters for Switchboards, Vehicles and Portable Service and Suggestions for Their Use.

By William W. Scott.

ELECTRICAL units of measurement are universally used, and these are known as the C. G. S. (centimeter, gramme, second) or "absolute" system of physical measurements. The practical units used in electrical calculations are:



Armature of Wagner Dynamometer Movement.

Ampere, the unit of current strength, or rate of flow.

Volt, the unit of electromotive force, electrical pressure, or difference of potential.

Ohm, the unit of resistance.

Coulomb (or ampere-second), the unit of quantity.

Ampere-hour, the equivalent of 3600 coulombs.

Watt (ampere volt or volt-ampere), the unit of power.

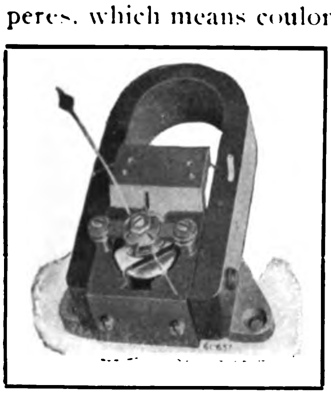
Joule (volt-coulomb), the unit of energy or work.

Farad, the unit of capacity.

Henry, the unit of inductance.

These are used in electrical engineering, but for the purposes of electric vehicle operation, the volt and the ampere are essentials, which may be defined in connection with the ohm as follows: Ohm, the resistance of a conductor through which a current of one ampere will pass when the electromotive force is one volt. Ampere, the quantity of current which will flow through a resistance of one ohm when the electromotive force is one volt. Volt, the electromotive force required to cause a current of one ampere to flow through a resistance of one ohm.

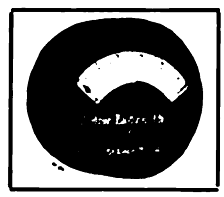
Current flow in a circuit is usually stated in amperes, which means coulombs a second, so that 10 amperes, for instance, means 10 coulombs a second, or a statement of the quantity of current that will pass in a second, but ampere hours will mean the number of amperes that will flow continuously for an hour. The ampere meter will indicate the quantity of current that is passing through a circuit at any given time within the range of the instrument for the period that the current is flowing. The ampere meter is known as the ammeter.



Permanent Magnet or D'Arsonville Movement of Wagner Instrument.

The voltage of a current is the pressure that causes it to flow in a circuit. That means that the voltage corresponds to the amperage as does pressure upon the flowage of water. The amperage may be constant, but the voltage may be very much varied, or the voltage may be constant and the amperage may be varied, these being dependent upon the resistance, which regulates the current. When a pressure of one volt will force an ampere of current through a wire, for instance, the resistance is one ohm, and if one volt will only force a half ampere through the wire, the resistance is two ohms, and to force one ampere through two ohms resistance the voltage must be increased to two. This simply explains the relations of voltage, amperage and resistance to each other.

The electric current should be considered as flowing from a higher to a lower level, the higher level being indicated by the plus mark +, and the lower level by the minus mark —, these indicating the direction of the flow, although sometimes for better definition arrows are used. The current always flows from the plus mark to the minus mark, which, of course, greatly varies quantity and pressure. In indications of battery circuits the positive terminal is represented by a long, light line, and the negative terminal by a short, heavy line, and the positive and negative plates of a single cell are similarly represented by alternate long, light and short, heavy lines.



Wagner Ammeter for Switchboard Service.

The measurement of a current of electricity flowing in a circuit is by an instrument that must measure in amperes, and such an instrument is known as an ammeter, a contraction of the term ampere meter. The instrument must be of a type that will measure all the current flowing in the circuit. The ammeter must naturally be of low resistance so that it will not materially influence the current. The ammeter is so connected that the current enters it at the terminal marked with a plus and leaves it at the terminal marked with minus. One must note that all the current passes through the ammeter.

The measurement of the pressure of a current of electricity in a circuit is by an instrument that must measure in volts, and such an instrument is known as a volt meter, but no current flows through it. It is tapped into the circuit so that it will indicate the pressure within the range of the instrument, but it does not become a part of the circuit, nor does it receive the

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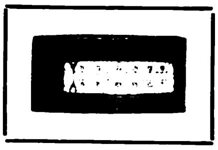
current that is flowing through the circuit.

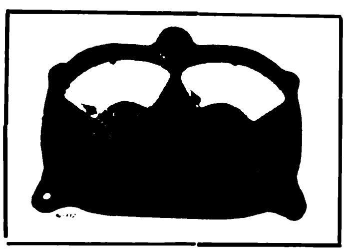
At this point statement may be made that resistance regulates the flow of the current, or amperage, and with the pressure in volts known one can practically compute the resistance that will allow a given quantity of current to flow. To illustrate, with a pressure of 10 volts and a resistance of one ohm a current of 10 amperes will flow, but to reduce the current to five amperes the resistance must be increased to two ohms. In other words, 10 volts will force just five amperes through two ohms resistance, and one may note that the resistance of two ohms equals the pressure of 10 volts divided by the current of five amperes.



Wagner Voltmeter, Horizontal Type.

The voltmeter and ammeter are really measures of resistance, for the resistance through which a given pressure will force a given current equals the quotient of the pressure divided by the current. The resistance must be known to obtain and regulate the necessary current to charge a battery. Current is measured by inserting a low resistance ammeter into the line carrying the current. Voltage is measured by tapping a high resistance voltmeter across two points in a line carrying a current, and the resistance is measured by dividing the voltmeter reading by the ammeter reading according to Ohm's law.

Voltmeters and ammeters are really small motors, the only difference being that in those designed for direct current use the poles are permanent magnets and the armatures do not rotate, but turn against springs. These armatures are used to move the pointers that indicate the values of the current on the scales, the current moving the armatures against the spring tension, and when the current is cut off the pointers return to a central location that is indicated as zero. The instruments used for alternating current measurement have what is known as the dynamometer movement, which differs from the permanent magnet type principally in the fact that the field is produced by two additional coils in place of the permanent magnet, and by reason of this a reversal of current effects a reversal of polarity of both members and permits the same indication. All instruments used in connection with vehicle battery charging are constructed for direct current indication.

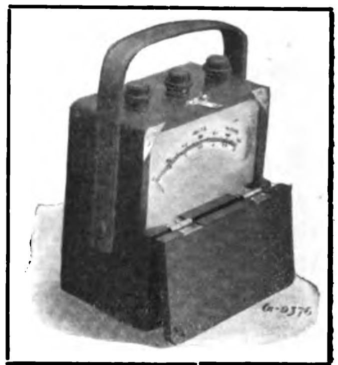


Combination Volt and Ammeter for Switchboard or Vehicle Use.

The permanent magnet type of ammeter or voltmeter used for direct current measurement is known as the D'Arsonville, from the principle of the construction, and it differs from the instruments constructed to the dynamometer or to the magnetic vance principle in that it will indicate polarity, which the dynameter movement instrument will not indicate, and in it the iron lag, a characteristic of the iron vane type, is absent. The D'Arsonville type is most generally used for motor vehicles.

In general construction the voltmeter or ammeter includes a small solenoid that is designed to oscillate, the core of which is mounted on jewelled bearings, arranged as is the armature of a dynamo between the poles of a permanent horseshoe magnet, with a pointer or hand pivoted at the bearing by which the variations of the electrical current, either quantity or pressure, is indicated on a scale. The control of the pointer is by a coiled steel spring attached to the shaft, and to insure accuracy the scales are calibrated by operation of the instruments against definite standards.

The principle of operation of a D'Arsonville movement is illustrated in an accompanying sketch, that at A being a detail drawing of the coil, and that at B showing the action of the coil when a current is sent through it. The coil is mounted on jewelled bearings between the poles of a permanent aged magnet indicated as N and S. The coil H I is held in place by the springs W, so that the pointer is at zero on the scale when no current is flowing through the coil. Should current be sent to the moving coil so that it is depressed along the side I and lifted along the side H, by reference to the top view, at B, one notes that the current would enter at I and leave at H. The clockwise circular field around I would strengthen the field of the permanent magnet NS above the wires I and weaken it below. This would deflect the coil I downward, and in a similar manner the counter clockwise field about H would strengthen the magnet's field below H and weaken it above, so that H would be lifted upward.



Portable Instrument for Testing Either Direct or Alternating Current.

The coincident influences would serve to turn the coil against the tension of the springs W, and the turning influence of the current upon the coil would be in ratio to the current. The stronger the current the stronger the influence of the combination fields that would cause the coil to turn. As the pointer moves over the scale graduated in amperes it would indicate the value of current in amperes, and such an instrument would be an ammeter. As the current in any coil is proportional to the voltage across its terminals, the movement of the coil must also be proportional to the voltage. If the scale were graduated to read in volts the instrument would be a voltmeter. It would, of course, include much greater resistance than the ammeter.

The permanent magnets used in voltmeters and ammeters are of a special quality of hardened steel that is magnetized to a point somewhat less than the full magnetic capacity of the metal, that has the qual-

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ity of great permanence. The soft steel pole pieces are secured firmly to the feet of the magnet, the joints being grounded and designed to be permanent. The

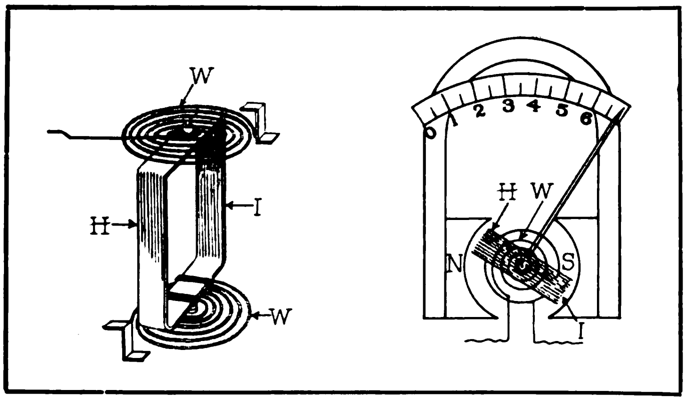

Diagram of the Coil of a Weston Ammeter and the Motor Action of a Weston Ammeter Coil.

core of the coil is so arranged as to make uniform the field in which its coil oscillates, and over it are wound two layers of insulated wire. The first layer is short-circuited upon itself to dampen the movement of the coil by the formation of eddy currents within, which causes the instrument to be aperiodic, or "dead beat" in indications. Above this short-circuited coil and at right angles to its direction is wound the "active coil", which is a series of turns of fine copper wire. The current is sent to this through the springs at either end of the core spindle that control the movement of the coil. In the voltmeter the active coil is in series with a resistance, and in the ammeter the coil is connected across the terminals of a shunt block. The shunt blocks are made of special alloy metal that has a temperature coefficient of approximately .001 at 100 degrees Centigrade.

The pointers of the instruments are rods or tube of hardened aluminum which are formed with an eye that is fitted to the spindle on which the core turns and with a counterpoise. The instrument is usually mounted on a rigid brass bracket, which prevents warping, and in such a manner that the movement can be taken out without removing the pole pieces. The scales for indication vary, for that of the voltmeter measures the pressure between battery terminals, whether charging or discharging, but the current that may be measured by an ammeter will flow in one direction in charging and flow in reverse when discharging. The ammeter suited for a continuous flow of current in one direction would not indicate and would be damaged were a current reversed through it, although it would serve every purpose were the terminal connections reversed. The current can be conveniently reversed by a reversing switch. For this reason the ammeter that is to be used where the current reverses, as in battery charging and discharging, is built with a scale with the zero at the centre, so that the indicating pointer may move in either direction in which the current may flow.

Voltmeters and ammeters are made in combination so that readings of the voltage and amperage may be made from a single instrument, and these are used in connection with pleasure cars, and sometimes in charging, although this type is not generally chosen for station or even garage equipment. They are occasionally used in the lighting and starting systems of gasoline cars. The volt ammeter is another type of instrument in which the same movement is used to indicate the voltage or the amperage, not simultaneously, but the one after the other.

Volt meters and ammeters built for switchboard use differ with those designed for vehicle installation chiefly in the fact that they are larger and more heavily constructed, and they are protected by casings that are intended to protect them from magnetic influences. These instruments are generally permanently installed and are, of course, of capacities sufficient for the work they have to do. They are used in connection with charging panels, with switchboards of different sizes, with rectifiers, with motor generator and rotary converter sets and are so connected that they may be used for indicating a number of circuits, switches being arranged so that readings may be made of each circuit, with reference to voltage or amperage, separately or simultaneously.

Switchboard instruments are constructed in capacities to meet any requirement, and these are with indicating scales that can be read easily by the operators. Those that are of the types used for ordinary conditions of charging, with currents of moderate voltage—are built with self-contained resistors, but those of greater capacities are used with the resistance in large part in a separate multiplier designed to be attached to the back of the switchboard. The accuracy of the instruments is insured by careful design and construction, by being calibrated for reasonable average temperatures, and the shunts are designed so that any change in the temperature of shunts will not affect the readings perceptibly.

Usually the shunts are not enclosed within the casings, but are separate from them, and are connected in series with the main conductor at the rear of the switchboard. The connections between the ammeter

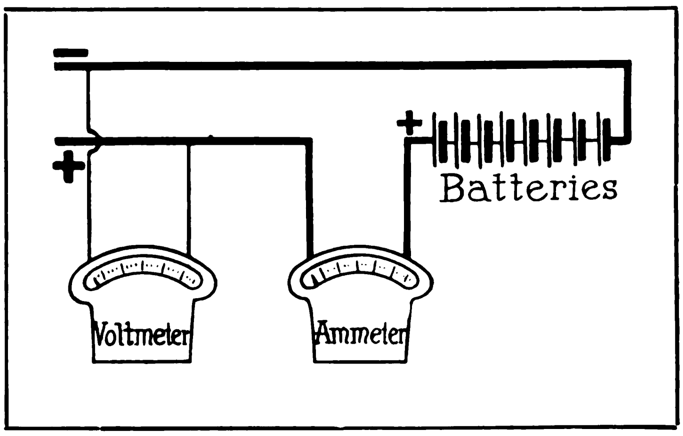

Diagram Showing the Connection of a Voltmeter and an Ammeter in an Electric Circuit.

and the shunt is by light, flexible conductors which have special terminals for connecting them to the shunt and the binding posts of the instruments. With

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selective switches ammeters can be connected with shunts installed in different circuits, an arrangement that makes for economy and satisfactory service. Obvious, were an instrument necessary for each circuit, the expense of charging equipment would be largely increased. For some installations the cases are designed to be mounted flush on the board, and with others the mounts are brackets on the boards. Where ammeters are used close to conductors carrying heavy currents they are fitted with self-contained magnetic shields, which are intended to protect them against disturbing influences.

The capacities of the voltmeters usually included in station or garage switchboard equipment are dependent upon the uses to be made of them. Where a garage or station is equipped to make repair and restoration of cells an instrument that will give very low readings is necessary, and for such purposes a scale might range from 0 to 3, for use with a single cell, because very close data is necessary to satisfactorily test and compare conditions during forming or restoration charging and discharging. Instruments with scales of from 0 to 15 may be used for similar work with small groups of cells, but for where battery charging is from apparatus that is intended for vehicle batteries of average proportions the scales may range 0-110, 0-150, 0-250 or 0-300. No instrument should be used with a voltage greater than that for which it is designed, as an overload will cause burning and damage.

The capacity of the 0-3 range voltmeter restricts its use to a single cell, and the larger instruments should have approximately the same degree of protection, that is, a sufficient excess of range over the voltage in which it will be used to insure against damage by overload. For instance, the 0-150 voltmeter will be ample for the 110 or 125-volt current, the 0-250 instrument for the 220-volt current, and should the current be supplied from a three-wire system having 230-250 voltage across the outside wires the range should be 0-300. This should only be used between the neutral and the outside wires, and not across the 250-volt potential.

When the switchboard connections are once made there is no reason to make changes, and the same statement will apply to instruments used for motor vehicle operation unless in the event of restoration and repair. With portable instruments used for testing, however, care must be taken to avoid overloads or conditions that might cause damage.

The leads by which the voltmeter is connected with the circuit are flexible insulated copper wires attached to the terminals, these usually being binding posts, and the free ends from these may be connected with the terminals of the taps in the circuit, and the connections should be secured to the terminals of the instruments so that there will be no possibility of damage through accidental short circuiting. Some portable instruments are built with two and three coils and are adapted for making readings on circuits of differing capacities by connecting the coil that is designed for the circuit with which it is to be used. With these the same positive terminal is used for all circuits. When this type of instrument is used and a voltage is unknown, the first reading may be by the circuit with greatest range, so to obtain an approximation first, and then an accurate finding.

When voltage is regulated on a switchboard variable resistance is afforded by the rheostats, in addition to the resistance of the instrument, but when used for testing no variable resistance is practical and the only prevention of damage from overload is by testing. If the instrument is not calibrated for more than one reading, or is used for tracing connections or learning the value of a wire that is not known, the indication will show which wire is positive. If the pointer moves and indicates a value the connection is correct, but if it does not move forward over the scale the connections should be reversed immediately.

Voltmeters used on a circuit, or with a group of cells that may be charged or discharged, will indicate the total voltage of the group, but when a voltmeter is used with a vehicle battery that is discharging the instrument will indicate the voltage of the couple in the circuit.

The majority of controllers are designed to keep the battery cells in series practically all the time, in which the voltage would not be changed, but if the arrangement of the battery for control is in multiple, series-multiple or series, the voltage will be whatever are the relations of the groups to each other. Were a 40-cell battery divided into four units of 10 cells each the normal voltage rating would be 20 volts for a unit, and in multiple the reading of the battery would be 20 volts, in series multiple 40 volts, and in series 80 volts, if discharging. In charging the voltage might be as high as 100 volts, which would be an average of 2.5 volts a cell, or even 104 volts, which would average 2.6 volts a cell, but after charging the voltage would fall perceptibly shortly after discharge was begun and would drop to an average of about two volts a cell, where it would remain practically stationary for a considerable part of the discharge period. Were the minimum voltage of discharge 1.75 a cell the lowest total voltage for the battery would be 70 volts. The condition of the vehicle battery may be indicated by the instrument when it is moving, at which time, if the cells are arranged in multiple or series multiple, the voltage will be that which the ratio of the unit will bear to the rated capacity of the battery.

The ammeters are designed for specific work and they should not be subjected to even trials on circuits where the amperage will exceed the range of the scale, and the best practise is to allow a reasonably safe margin to insure against any possibility of damage. Other than this the only condition of their use is to utilize them with the shunts furnished by the manufacturers.

The majority of pleasure cars are equipped with volt-ammeters, or the combination instruments that are sometimes known as "duplex". These have the

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same characteristics of the single constructions, the voltmeter movement indicating from 0 to the maximum necessary by the battery used in connection with it, and the ammeter having a "zero-centre", so that it will indicate in either direction, whether charging or discharging. The voltmeter will always indicate the voltage sent to the motor while the vehicle is being operated, but will, when charging, indicate the current supplied to the battery in series. The ammeter will indicate the amperage of the charge or discharge. With many vehicle instruments the maximum voltage that may be allowed for charging, and the minimum voltage that is allowable when discharging are indicated by red lines on the scales.

The use of portable instruments is largely in connection with battery testing, and as the switchboard indicators will be sufficient for an entire battery or a group of cells, the range of these need not be large. They must have scales that will permit of closer readings, however, and while single instruments are designed for definite ranges, there are types that can be used with differing outside resistances, with two ranges and two self-contained resistances, with duplex movements, and with triplex arrangements. The duplex instruments will indicate simultaneously, but the two and three-range indicators must be used for consecutive readings. With these, what has been stated with reference to the large capacity instruments will apply.

In vehicle operation the voltmeter indicates the available voltage of the battery, so that the driver may learn at a glance what capacity remains, and the ammeter shows the amperage that is being drawn from the battery. The voltmeter may, after climbing a grade or driving through sand, show a marked reduction, but this does not indicate that the battery is exhausted. On reaching a level way the voltmeter pointer will rise to normal, the heavy temporary demand having thus influenced the battery. The ammeter will register any excessive draft upon the battery.

(To Be Continued.)

REMY ELECTRIC ELECTS OFFICERS.

The following officers were elected to control the Remy Electric Company, Anderson, Ind., at the annual meeting held at Indianapolis March 1: S. A. Fletcher, president; Hervey Bates, Jr., vice president; H. W. Griffith, secretary-treasurer and general manager; J. C. Woods, assistant to the president. The board of directors is made up of the officers and Theodore Stempfel.

TROY TRAILERS FOR EUROPE.

The Troy Wagon Company, Troy, O., has, so statement is made, received an order for $500,000 worth of Troy trailers to be used by the warring nations in Europe.

BIG DUPLEX TRUCK ORDER.

Company Contracts to Deliver 375 Machines for World-Wide Delivery.

A contract just entered into by the Duplex-Power Car Company, Charlotte, Mich., that will require the manufacture of 375 two- and three-ton trucks of the four-wheel drive type that this firm specializes, is of special significance in that it is not for delivery to any nation now at war, although the machines will be distributed all over the world.

The order is regarded as being the most important obtained by any concern engaged in manufacturing trucks, for it was based on high efficiency. Statement is made that 25 of these machines will be produced as quickly as is possible, which are to be used for demonstrating purposes and will be sent to London, Paris, Buenos Aires, Johannesburg (South Africa), Petrograd (St. Petersburg), and to many other large distributing points in England, France, Russia, South Africa, Australia, Japan, China and South American nations where the contracting company is represented.

This contract will extend over a period of years, and is entirely apart from orders that have been received for machines that will be utilized for military purposes, which incidentally aggregate a considerable total. The value of the contract is regarded from another commercial aspect,—the conditions that will obtain when peace has been declared. When war has ceased there is belief that the European nations will not be able to more than meet their own requirements, and the demand for machines in the nations where it is represented can be met by the Duplex company promptly and with machines that are well known and can be relied upon for exceptional service.

DIRECTORS APPROVE STOCK INCREASE.

The directors of the Youngstown Sheet & Tube Company, Youngstown, O., have approved a proposed increase of the capital stock from $25,000,000 to $30,000,000, and stockholders will be asked at a special meeting called for April 6, to sanction the increase. It is proposed to issue preferred stock, which will make a total for the corporation of $10,000,000 preferred and $20,000,000 common. Of the latter $18,000,000 is said to be outstanding. Opposition on the part of the stockholders is not expected, it is declared.

RUBBER GOODS PAYS USUAL DIVIDENDS.

The usual quarterly dividends of 1¾ per cent. on preferred and 1 per cent. on common stocks were paid March 15 to stockholders of record March 10 by the Rubber Goods Manufacturing Company, New York City. The next annual meeting will be held April 8 at Jersey City, N. J.

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MOTOR TRUCK CONVENTION PROBLEMS.

EFFORTS are to be made by the members of the Commercial Vehicle section of the National Automobile Chamber of Commerce, at its convention in Detroit, May 5 and 6, to secure common agreement on a number of troublesome problems that have been disturbing the truck manufacturers.

With a view to making the results of the gathering as far reaching as possible, makers outside of the chamber have been asked to participate. Anybody interested in the motor truck is invited to make suggestions. The result of the discussions will not be binding on those attending, but is likely to have great influence upon the policies adopted by the leading makers.

One difficult undertaking which the convention has set itself, is to establish, if possible, a standard of service to be given by the dealer and manufacturer to the truck owner after the truck has been sold. To this end Alvan Macauley, vice president and general manager of the Packard Motor Car Company, will deliver a paper entitled "Can Manufacturers Have a Standard Service Policy?"

He will supply the meeting with a statement of the provisions of a service policy which the Packard company has had in operation during the past year, and it is hoped that with such amendments as the meeting may suggest this may be adopted as the standard by all the manufacturers present. This statement of policy was printed recently in the Motor Truck in connection with a description of the service given by the Packard Motor Car Company of Boston.

Another question of great interest, both to truck buyers and truck sellers, is that of selling on time payments. This question will be handled by Windsor T. White of the White company in a paper entitled "Advantages of Selling on Time Payments and How Such Sales Should Be Handled." He will describe the successful experience of the White company in selling on that plan.

H. Kerr Thomas, assistant manager of the Pierce-Arrow Motor Car Company, will read a paper entitled "Can a Standard Load Rating Be Devised and Approved by the Manufacturers?" Mr. Thomas has worked out a method of basing the load capacity of the truck on horsepower, gear ratio, wheel diameter, tractive effort and other factors. He has worked out a formula by which capacity can be figured just as the horsepower of a motor is determined and will offer this for criticism and adoption.

At the present time there is no way to tell how one truck compares with another in carrying capacity except by a careful study of all the specifications. If the formula were adopted it would be possible to tell at once whether it had been conservatively rated or over-rated by its manufacturers.

Among other important papers to be heard at the convention will be one by Vernon Monroe, president of the International Motor Company, who will talk on "Why Service Conditions Should Be Carefully Investigated and Recommendations Made Before Selling a Customer." Mr. Monroe's company has had a long experience in marketing a line of trucks ranging from one to 10 tons, which have naturally been operated under almost every condition that it is possible to encounter. "What Can Be Done to Improve Conditions in the Truck Business?" is the subject of a paper to be read by John R. Van Allen of the Atterbury Motor Car Company.

Invitations to the convention were sent out some time ago and so far a large number of acceptances have been received. These are about equally divided between truck manufacturers who are members of the Chamber of Commerce and those who are not. Everything indicates that the attendance will be a very complete representation of the truck business in the United States.

CALIFORNIA LEGISLATION.

Recent legislation in California provides for the following: License plates need not be changed each year, but a small disc will be attached indicating the year. This is expected to save $40,000 a year. All vehicles, whether motor or horse drawn, shall carry a light after dark. Speeders, after a second conviction, shall lose their licenses for six months.

PROTESTING FREIGHT INCREASE.

Manufacturers of automobiles are protesting through the National Automobile Chamber of Commerce against the efforts of the railroads to increase the rating on pneumatic tires in carloads from third to second class. It is felt that any additional increase would be unfair, especially in view of the decreased value of tires as compared with the values when the third class rating was fixed.

HOUSE ORGAN FOR APCO.

The Auto Parts Company, Providence, R. I., maker of the Apco line of Ford specialties, is publishing a house organ termed the "Ford Dealer", which contains numerous items of peculiar interest to the Ford dealer and garage man. It is published on the 20th of each month and will be mailed free to the trade upon request.

The Thomas Brothers Aeroplane Company of Ithaca, N. Y., is reported to have received from one of the European governments involved in the war an order for a number of military tractors valued at about $100,000.

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"JITNEY" SERVICE AS A BUSINESS PROPOSITION.

Use of Pleasure Cars by Individuals Will Undoubtedly Lead to Organized Operation of Vehicles Specially Adapted for Passsenger Transportation.

WHETHER the "jitney" 'bus service is to be a permanent transportation institution is a matter of vital interest to everyone, the car operators themselves, the travelling public, the motor vehicle manufacturers, and, probably most of all, the street car operating companies. Its rapid development in all parts of the country, not excepting the conservative municipalities, would indicate that carefully organized and with expert administration it can become a beneficial auxiliary to the existing means of travel.

An Average Machine in "Jitney" Service, Without Means of Protecting the Passengers.

The development of the "jitney" service has been extraordinarily spectacular. Perhaps in that fact can be found the reason why there are so many in the cities of the country at this time. It has been stated that when the novelty, both for the public and the operator, wears off, a majority of the cars will disappear from active participation. In their place will come vehicles constructed especially for the service and operated by corporations with adequate financial standing, just as similar lines exist in some American cities and particularly those in operation in London, Berlin and Paris.

In view of the statement, which is considered extremely conservative, that there are now about 7000 registered owners and operators of "jitney" cars in the country, it would appear that Providence, R. I., is an exceptional case in the acceptance of the new transportation idea. The first "jitney" was licensed in that city on Feb. 8. Two months later to a day, there were 726 such cars registered and in operation. The cars in operation in the adjoining cities and towns of Pawtucket, Cranston and Central Falls brought the total for the four municipalities up to nearly 1000. The remarkable feature of this is that in the whole State of Rhode Island there are about 16,000 automobile cars, wagons and trucks, and thus the ratio of "jitney" owners and operators in relation to the cars of the state was one in 16. These machines were dependent on the patronage of a population of about 400,000.

Operated by Corporations.

Some cities of the Middle West and the Pacific Coast have an almost equal number of "jitney" machines. In Los Angels, San Francisco and Seattle there are large fleets of cars in operation, many of which are controlled by corporations recently created for the purpose. In Texas it is stated that some of the street car companies have been forced by the competition with the "jitneys" to reduce the operating time schedules, and to take some of their cars out of service.

In whether or not the five-cent motor 'bus service can successfully compete as a business proposition with the street railroad transportation lines is the crux of the question of the permanency of the "jitney." Trolley car corporations have been thought of by the peo-

Public Now Has the Service of Street Railroads Operated on Schedule and the "Jitney" Cars on a Go-As-You-Please Basis.

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ple as predatory institutions, which have little regard for the public as long as they do not have to meet competition. Be that as it may, these street car systems maintain service standards, and these standards of service the "jitney" must equal or exceed to win the lasting favor of the public. To be successful the new service must offer the same conveniences at an equal or less price to the individual. They must have sufficient financial backing to meet damage suits, etc. They must be operated on continuous time schedules in all kinds of weather, and probably in particular cases be able to give transfers from one line of 'buses to another as the street cars do. In this respect, the fact that the "jitney" cars absolutely ceased operations when the recent Easter "blizzard" unexpectedly came was given by many as an indication that the new service could not compete with the trolley car systems. The latter maintained their operations, but only at heavy expense for clearing the tracks. The "jitneys" went home. In the winter months the motor cars must afford the same, or better, heating and ventilating systems, as the street cars, and must maintain their operating schedules.

"Jitney" Cars at the Civic Centre of Providence, R. I., in Competition with the Trolley Lines.

Some Militating Factors.

It might be said that the street car corporations can handle the traffic in the winter months. They cannot be expected to maintain their costly organizations and equipment through a period of meagre receipts in the summer for the purpose of "filling in" when the "jitney" could not profitably operate in the few winter months. They would be compelled to increase their rates of fare to meet the deficits in their revenues, if they could "weather" what for them would be the dull system.

There is one condition of the use of the smaller "jitneys," the two, three and four-passenger cars, to which the public in its first enthusiasm does not seem to object. That is overcrowding. Conditions in this respect are prevalent in the new service in most cases. The same conditions in the street car systems have always aroused the public to bitter denunciations of the corporations. Casual examination of the motor vehicle service, especially during rush hours, will show that the passengers so fortunate as to secure seats are crowded in as tight as the proverbial "sardine in a box." In many cases passengers will be found riding on the running boards, which is not only a tax upon the machine, but is exceedingly dangerous to the person.

Convention to Improve Service.

However, the operators themselves have seen these disadvantages and are striving to better the service. The National Jitney Association, Kansas City, Mo., has sent out invitations to the various "jitney" interests throughout the country to assemble in a national convention on May 4-6. The invitation states among other things: "Let us take concerted action on the big problems that are confronting us daily. No man can say at this time what the near future will develop, but we feel sure this is a pioneering movement destined to revolutionize the transportation problem, and the carrying of people in our cities and suburbs. The people flocking to us by the thousands to avail themselves of the quick, pleasant mode of transportation we are offering, is conclusive evidence of the above fact. We are receiving so many letters daily from all parts of the country that we are calling in this city on May 4, 5 and 6, a national convention of jitney people for an interchange of views bearing upon vital points, such as legislation, insurance, safety in operation, licensing of drivers, style of equipment best adapted to the different classes of service under different conditions, etc., and at the same time lay a foundation for a strong nationwide organization. We feel that such a move will strengthen us in every way, give the public more confidence in the stability of the service, and bring to our aid the manufacturers throughout the whole country with their valuable suggestions and advice, and in every way advance the general movement in all sections."

In lieu of large financial backing such as other transportation systems have found it expedient to have, many organizations have asked their members to contribute to funds which will be used to defray the expenses of damage suits that members of the organization may be drawn into through accidents involving their particular machines. They have undertaken to apportion the routes of the city so as to avoid competition among the operators, have laid down schedules to which the members are requested to conform, and have sought to establish terminals. These attempts are taken as favorable indications that the service will be rescued from the chaotic condition in which it is at the present time.

As in every other industry, the permanency of the "jitney" 'bus service as a whole will be determined by the possibility of maintaining it upon an operating

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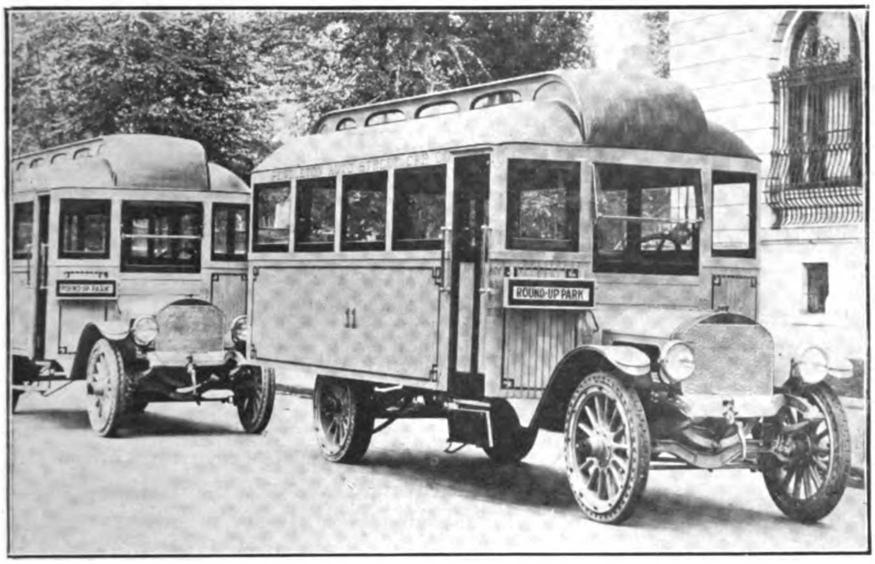

Type of Enclosed Motor Omnibus Specially Designed for Use in a Western City for Serving Regular Routes.

cost basis that will admit of successful competition with the street car systems. Several attempts have been made to compute the operating cost of "jitneys," but the majority of these are not acceptable because they are on a day basis, which is not sufficiently accurate because of variable mileage. The following estimates have been made from carefully kept figures that cover a long period of operation under variable conditions.

It has been found that a small car, which depreciates in three years, driven by one man, carrying a small passenger load, and not abused and is well kept, will average an operating cost of 7.6 cents a mile. Wages for the driver are not included in the estimate.

A small car that depreciates in four years, carrying the driver and a small passenger load, and is well kept and not abused, will have an average mileage cost of 8.44 cents a mile. No provision for wages made for the driver.

A car that depreciates in five years, carrying several passengers under normal conditions, well kept and not abused, will have an average mileage cost of 13.23 cents a mile.

A five-ton truck, which depreciates in five years, averaging a daily mileage of 41.4 and ton mileage of 103.5, costs, including driver's wages, an average of 31.6 cents a mile. This estimate is low because of the manufacturer's guarantee. In the second year of operation the cost would probably average 35 cents, and in succeeding years about 37.5 cents a mile.

These estimates include every factor entering into the operating cost of the several types of motor vehicles. It will be seen that the cost of operating the small car that depreciates in four years is more than 25 per cent. of the cost of operating a five-ton truck carrying a capacity load.

These figures are taken from the records of a company that has a system of accounting that computes the cost to 1-1000 cent a mile, and by it expense to be found for any desired period, year, month, week or day, but because of the variability of service daily or weekly or monthly operation expenses will not apply. The method of the company is to include the items of cost in each day's record, there being constants for overhead, depreciation and other fixed charges and variables for the other factors. These are then averaged for the different periods, the week, the month and the year for the purpose of comparison, and the total cost, divided by the total mileage for the period, will show the average cost a mile. The figures quoted were for a year, and can be regarded as thoroughly dependable. In connection with these attention is directed to the fact that no profit was expected of the machines other than interest on the investment.

Licenses, Bonds and Insurance.

Other factors that must be taken into consideration in computing revenue and expenses are costs of license, which several states now propose to increase, and of insurance. The insurance companies are said not to be anxious at this time to take insurance on "jitneys," and it is further stated that such machines would be classed under a rate higher than the ordinary insurance for pleasure cars. Ordinary automobile lia-

The Double-Decked Omnibus Generally Used by the London General Omnibus Company, the Largest Motor Vehicle Public Service Company of the World.

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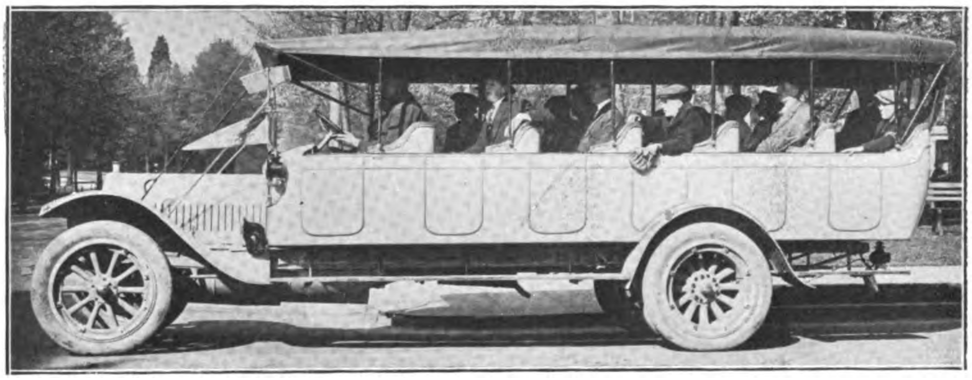

Adaptation of the English Char-a-Banc Type of Body to a White Truck Chassis for Use in Long and Interurban Service.

The majority of machines do not afford protection from the elements, and, while riding in them may be pleasant in fair weather, in inclement conditions the public will demand conveniences and shelter equal to what is given by the street cars.

Examples of Public Service.

Motor driven vehicles as transportation agents are not new factors either in this country or abroad. The Fifth Avenue Coach Company's lines that operate through Fifth avenue and other thoroughfares of New York City can hardly be called a "jitney" service, inasmuch as the rate of fare is double that which is designated as a "jitney." It operates double-decker motor 'buses on schedule, taking on and discharging passengers at street corners at the curb. In addition, the company issues transfers to other routes of its lines at designated transfer points. However, the cost of operation of these vehicles cannot be compared with those of the "jitneys" in other cities because of several reasons. One is that its routes are over streets on which no other form of public transportation, excepting taxicabs, are permitted to operate, and the surfaces of these routes are very level, exceptionally smooth and kept clear of snow, etc. For the same reasons, the omnibuses of London can hardly be compared. In London the motor fuel costs more than in this country, which is probably more than offset by the smooth and level thoroughfares over which they travel, which maintain lower fuel expense and minimum tire cost, two substantial factors of operation in the majority of American communities. A London 'bus, an equipment generally used by the London General Omnibus Company, the largest motor vehicle public service corporation in the world, is shown in an accompanying illustration. This 'bus is similar to those used by Fifth Avenue Coach Company, but differs from others.

bility insurance protects the owner by injury or fatality result from accident, or damage to other people's property, when travelling, but the minute the owner charges his passengers a fare that policy does not continue effective. A higher rate is charged for automobiles which may be used for party and pleasure purposes, but not for commercial purposes; there is livery automobile liability insurance and there is also a rate for taxicabs. The livery rate, under which "jitneys" probably would be classed, involves a premium of about $200 for a liability insurance of $10,000 for personal injury.

In addition to licenses and insurances, there is the matter of bonds to be considered. In the case of individuals owning and operating "jitneys," it has been declared advisable to demand a bond sufficient to cover damage costs in accidents. Bonds could easily be arranged for by organizations or corporations, but to many of the individual operators it would prove a prohibitive cost and thus eliminate them.

Better Types of Machines.

All of these matters are under consideration at the present time by the "jitney" interests, and from present indications it would seem that they will eventually be adjusted so that the five-cent motor 'bus service will become a permanent feature. The service, which is now in its formative stage of development, will probably develop types of cars more suitable for transportation requirements. Those now generally in use are small and light, seating usually four passengers besides the driver. Even with some of the passengers riding on the running boards, and providing the authorities permit such conditions to continue, the earning capacity in relation to operating cost is meagre as a whole. Serving a small number at each trip, it is necessary for a machine to cover large mileage, with the consequent expense for fuel, lubrication, tires, etc.

GMC Chassis with a Passenger Body Designed for Service in Southern California Between Contiguous Cities.

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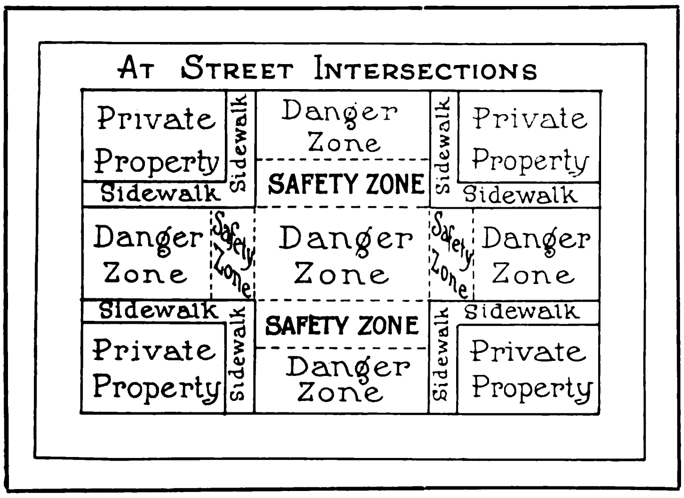
SAFEGUARDING CONGESTED CITY STREETS.

NEW YORK state is the latest to attempt legislation tending toward making the streets and highways safe for pedestrians by establishing zone systems wherein the foot traveller can walk without fear of motor traffic. Such a bill, which was drafted



Danger and Safety Zones at Street Intersections as Proposed for New York State Cities.

by James L. Crawford of New York City, is now before the state legislature, with satisfactory prospects of becoming law.

The recent statement of the National Highways Protective Society that 21 persons were killed on the streets of New York City by motor vehicles during the month of March has brought added emphasis to the necessity of some such regulation of vehicular traffic and of pedestrian traffic. Those in a position to know state that the pedestrian is at fault in most accident cases. Arthur Williams, president of the American Museum of Safety, has declared: "It has been found that a very large percentage of accidents—as high as 85 per cent.—are the result of carelessness on the part of the person injured."

In connection with the zone bill aforementioned, Mr. Crawford explained as follows: "Carelessness being a mental defect, it is clear that the fundamental cause of from 85 to 90 per cent. of street accidents is mental. If this is admitted, it is obviously necessary, in order to get at the root of the trouble, to adopt a method of regulation of street traffic, which will automatically impose a powerful and continual mental check on all ordinarily intelligent adults—whether drivers or pedestrians—in their use of the streets; a mental check that will compel such adults to exercise that constant care and vigilance which in the extremely dangerous conditions of present day city traffic, is absolutely necessary to the avoidance of accidents."

The bill not only provides for mental checks, but seeks to place the responsibility for accidents. A similar recommendation was made recently by the coroner of Pittsburg, who asked the local police authorities to declare it a misdemeanor for a pedestrian to cross a street except at the officially recognized and properly marked street crosings.

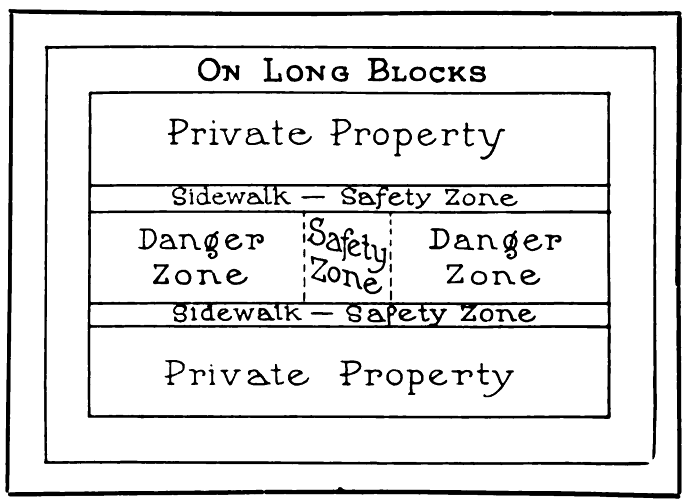
Under Mr. Crawford's plan the streets of first and second class cities of the state would be divided into safety and danger zones, and the responsibility for accidents happening within those zones would be determined by the location in which the accident may happen. The author of the petition further claims that by placing the burden of proof of accidents, as the bill provides, will act as a powerful mental check upon both driver and pedestrian. The terms of the bill as originally presented are given as follows:

Safety and danger zones. All streets within the boundaries of each city of first or second class, shall be divided into safety and danger zones. Each safety zone shall be available for the purpose of enabling pedestrians to cross the track of vehicular traffic in comparative safety, and shall comprise a section of the roadway at each crossing or intersection of a street. Each safety zone shall be a width of 20 feet from the building line at each intersection of streets, and of 20 feet at right angles to the building line, at any other part of the street, which may be designated as a safety zone by the responsible road authorities. The sidewalks, from building line to curb, shall be safety zones for pedestrians. All other parts of the street, used for the purpose of vehicular traffic, whether mechanically propelled, horse drawn or otherwise, shall be danger zones for pedestrians.

Presumption of law in accidents. Drivers of vehicles and pedestrians shall be at liberty to use the streets, including both safety and danger zones, subject to police regulations for the time being in force, but in the event of an accident occurring, resulting in the death or injury of any pedestrian, driver or passenger, or in damage to property, through collision with a vehicle on the street, or otherwise, the presumption of the law as to the responsibility for the accident will favor the pedestrian, and the driver or owner of such vehicle shall be presumed to be in fault, and to be guilty of negligence or contributory negligence, unless the contrary is proved, if the accident occurs within a safety zone; and the presumption of law as to the responsibility for the accident will favor the driver, or owner of such vehicle, and the pedestrian shall be presumed to be in fault, and to be guilty of negligence or contributory negligence, unless the contrary is proved, if the accident occurs within a danger zone.

Burden of proof. Limitation of scope. Beyond placing the burden of proof on the driver or owner of the vehicle, or on the pedestrian, in accordance with the location in which such accident occurred, this article shall not effect the existing laws relating to civil or criminal prosecution, or alter in any way the existing road or traffic regulations.

In laying out the danger and safety zones, as is shown in accompanying sketches, it would not be necessary to enter into much expense. The zones at



A Long Street Block Broken by Safety and Danger Zones to Safeguard Pedestrians.

street intersections would be shown by the existing curbings, etc., while in the case of zones laid out in the middle of long blocks, it would be necessary to

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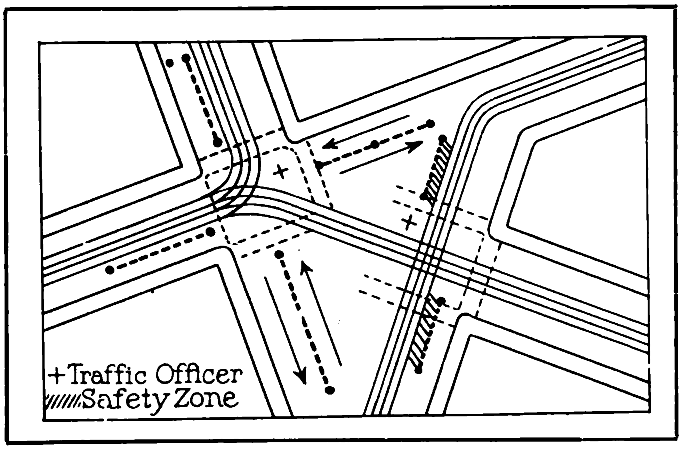
provide only four posts, set at the curbs, to indicate the zone boundaries.

The present liberties of driver and pedestrian are not infringed upon. The latter may cross, move about, or stand still, on any part of the danger zone of the street; but he does so at his own risk, and if a vehicle should strike him while he is in the danger zone, then the law would presume that he is primarily at fault, and the burden of proof will be his to satisfy the court that the accident was due to the culpable recklessness or carelessness of the vehicle driver. In the case of the driver he may propel his car in any part of the safety zone in the street; but if his car strikes a pedestrian, then the burden of proof rests upon him in case of a damage suit.



The Tennis Court Traffic Plan by Which Detroit Has Solved Many of Her Traffic Problems.

Legal precedent in the case of injuries sustained in safety zone has already been established. A California court decided that a woman who was struck by an automobile as she was alighting from a street car, and did not look to see whether there was danger in that zone was not guilty of negligence. The defendant contended that the woman was negligent, and, therefore, partly responsible for the accident, because she had not ascertained if danger was imminent. The court held that the woman had a right to assume that the safety zone would be perfectly safe for her, and her failure to look for danger could not be construed as negligence, but that the driver of the automobile violated the law by driving into the safety zone.

Better Traffic Regulation.

The subject of traffic regulation is engaging the attention of an army of experts, who are working according to the varying conditions in the cities. A plan similar to that suggested for New York state cities has been in force in Detroit, Mich., for nearly a year. Because of its peculiarities it is known as the tennis court system, which is shown in an accompanying sketch. Important street crossings are marked off into safety zones by white lines, which suggest the boundary markers of the tennis court. The crossing lanes for pedestrians, which are safety zones, are virtually extensions of the sidewalks, being about the same width, 18 feet, and are ruled off by white lines on the pavements. The trolley stopping places are safety zones, and so indicated by white lines that enclose an area about 60 feet long and six feet wide, measuring from the car tracks. Pedestrians must keep within the white lines, and vehicle drivers must keep to their side of boundaries. Traffic can be resumed through certain of the safety zones when the traffic officer on stationary post so indicates that it is proper to do so. Infringement of the regulations is quickly and severely punished.

The Rotary System of Movement.

Owing to conditions at Columbus Circle, New York City, another system of traffic regulation has been adopted, which is popularly known as the rotary system and resembles some of those in force in European capitals. By referring to an accompanying sketch it will be seen that vehicular traffic revolves around the monument in the centre of the circle in a rotary mass, always bearing to the right. Iron standards, connected by rope guides, form an inside circle, within which vehicles are forbidden and where pedestrians can safely stand to await cars, etc. Traffic conditions at various street intersections throughout the city differ according to the manner in which the streets cross each other and the volume of traffic, and, therefore, numerous systems are in force. There is the single traffic officer who regulates vehicular and pedestrian traffic by his upraised hand or by whistle, the safety isles placed in the middle of wide thoroughfares at crossings, streets that are closed off to vehicles during certain hours of the day—in most cases to allow the children to play there—and streets some parts of which are given over the pedestrians as safety zones entirely, the vehicular traffic passing in parallel streets.

One-way streets, and restricted thoroughfares, have found much favor in several cities. Boston is one of the best examples of one-way streets, it having traffic problems, due to its narrow and winding thoroughfares, that are not met with in many municipalities. By one-way streets is meant that vehicular traffic can flow only in one designated direction, and

Rotary Traffic System in Use at Columbus Circle, New York; Arrows Indicate Direction of Traffic Flow.

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in the case of restricted streets, all forms of vehicular traffic is forbidden. Traffic experts claim that one-way streets would solve Chicago's traffic problems, especially in the Loop district. Such a system is not only applied to Philadelphia's vehicles in some areas, but several street cars are regulated by the same method.

With the increase of population, the increase of vehicles, and the consequent increase of street congestion, it is becoming daily more imperative that some system of regulation which will not interrupt the flow of either vehicular or pedestrian traffic, be adopted throughout the country. While accidents probably will continue to happen, owing to the human element that enters so largely into the case, regulations must be imposed that will help to check that mental defect which Mr. Crawford states is the fundamental cause of from 85 to 90 per cent. of street accidents.

JEFFERY REVERSIBLE ARMY TRUCK.

The Thomas B. Jeffery Company. Kenosha, Wis., has designed and shipped to England the first reversible army truck manufactured in America. It is a two-ton "Quad" with four wheel braking and steering connections and a driver's seat at either end. The engine is guarded by a light steel plate at the rear and the starting crank is mounted behind it, being connected with a chain and sprocket to the crankshaft. A Bijur electric starter is also carried.

The gearset is reversible and has four speeds in either direction. The reverse gear has been removed from the stock gearset and a fourth gear inserted instead. The steering wheels at both ends of the car are interconnected and so are the clutch and brake pedals. In military service there would be two operators in communication with each other by electric buzzers. Speed in either direction of 35 miles per hour can be obtained.

MICHIGAN LIGHT BILL DEFEATED.

A bill in the Michigan legislature designed to compel all vehicles to carry lights visible from the front and from the rear was defeated by the House of Representatives, after it had been passed by the Senate. The representatives from the rural districts opposed the bill, claiming that it was unfair to their constituents. A proposed amendment that would exempt farmers failed to win the opposition to its passage.

MOTOR TRUCK FOR MANSFIELD, O.

The city council of Mansfield, O., has adopted a resolution to purchase a motor truck for the water works department. It is expected that $5,500 will be expended, the sum to be transferred from the fund of the department.

STANDARDIZING TREADS.

Improvement of Southern Roads Lessens Demand for 60-Inch Types.

Southern motor vehicle dealers who have found it very difficult to get deliveries on time of cars built with the special 60-inch tread, which has always been demanded for southern roads, are urging upon the manufacturers the establishment of a standard 56-inch tread for all parts of the country.

The necessity for the wider tread has never been very evident. It is a dimension that was originated in the South, and having been adopted and once established and the roads marked with tracks 60 inches apart, the people demanded it and so far as the South was concerned the 56-inch tread would not suffice.

Recently improvements in roads has made it quite practicable to use a 56-inch tread on many of the southern roads, and one after another the passenger car manufacturers have been dropping the production of the wide tread until now only about a dozen builders of the smaller and more moderate priced passenger cars continue it.

It is a question which as regards to trucks affects only the light types and the front wheels of the heavier machines. The dual tires of the heavy duty truck add so much width to those wheels that whether the tread fits exactly the road tracks or not they will not usually sink into the ruts. From the manufacturing point of view it would naturally be of great advantage to establish a standard tread for the entire country, as the special work required to produce the 60-inch type is expensive. Standardization might have some small influence in bringing about further reduction in the list price of cars and trucks.

The movement for standardization is not confined merely to manufacturers of motor cars and trucks, but an effort will be made to secure agreement to a policy of standardization from the horse vehicle manufacturers as well.

The committee of the National Automobile Chamber of Commerce, which has the movement in hand, consists of C. W. Nash, Carl Pelton, J. Walter Drake, E. R. Benson and C. S. Jameson.

FIRESTONE REDUCES TIRE PRICES.

The new schedule of Firestone solid truck tires, manufactured by the Firestone Tire & Rubber Company, Akron, O., provides for a net price which is 10 to 15 per cent. lower than any net prices given in previous Firestone lists after deducting discounts. Consumers' discounts are eliminated from the new schedule. E. S. Babcox, advertising manager, states that larger volume of sales, lower cost of crude rubber, an efficient distribution, and lower production cost make the reduction possible.

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TRUCK WIRELESS STATION.

Jeffery "Quad" Equipped for Portable Service of United States Army.

The possibilities of wireless telegraphy are well enough understood by the public in a general way, even though the theory, practise or science of design, construction and utilization are comparatively unknown. The value of radiography is best realized in connection with shipping, but its utility for military purposes is of even greater importance.

Signal Corps Erecting the Wireless Mast on the Jeffery "Quad" Portable Station.

The Signal Corps of the United States army utilizes all manner of communication, visual signals, field telegraph and telephones, and wireless for service where vision is obstructed or distance is too great for other means. The wireless stations permanently located have material value, but in the event of operations portable apparatus that can be moved quickly and wherever desired has advantages that are obvious.

A number of months ago the Signal Corps conducted extensive experiments with a truck equipped as a station, which was found to be so satisfactory that the second machine has been added, and there is reason to believe that in a comparatively short time a considerable number will be equipped and stationed in different sections of the country where they will best serve the purposes of the service.

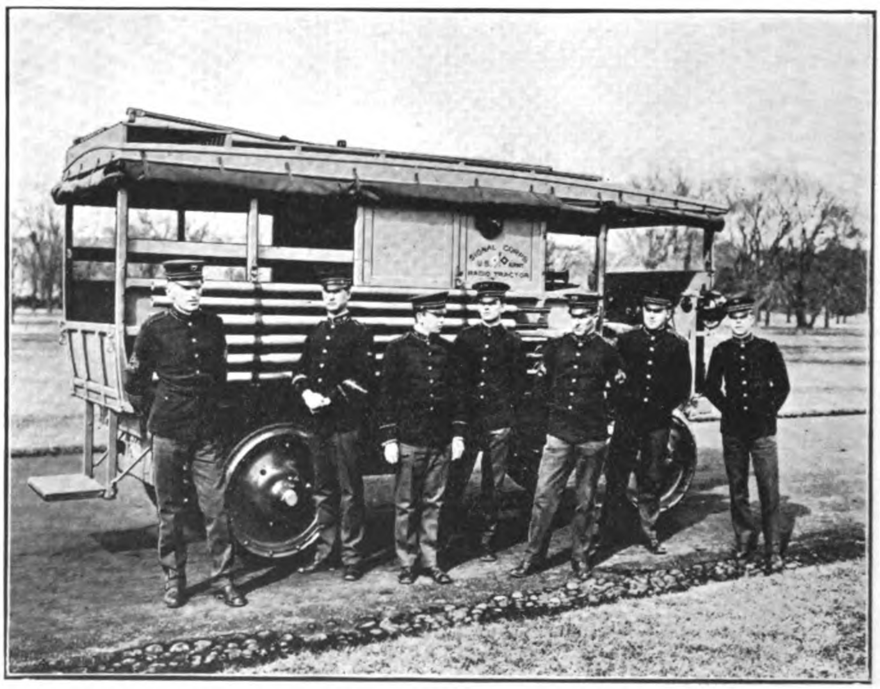
The second machine is officially designated as "Radio Tractor No. 2" and it has just been tested for a considerable period at Fort Myer. The accompanying illustration shows that it is a chassis equipped with a permanent top supported by stanchions, with the middle section protected by sides. The remainder of the body is open, but can be enclosed by curtains. The chassis is a Jeffery "Quad" and the body was built to specifications of the department. The machine is driven and is steered by all four wheels, and on these the brakes operate. Because it has traction with every wheel the machine can be driven up and down ascents and descents that would be impossible for other types of trucks, and it can push and pull through sand, mud or snow, or traverse rough ground that could not be attempted with other vehicles.

The body is built with a platform at the rear of the roof, on which can be erected a tripod, which serves as a derrick to raise the wireless station mast. The mast is 80 feet in height when erected and consists of eight sections of tube, which are carried in slings on the sides of the body. The mast is jointed and hoisted, wire guys holding it as it is raised or lowered. The crew of the "tractor" can locate a station in comparatively short time.

The ordinary sending range of the station is 250 miles, but its receiving range is almost unlimited. The electric current for sending is supplied by an electric generator of two kilowatts rating, which is driven by the motor of the chassis, the shifting of a lever being sufficient to couple the generator whenever it is used. The apparatus is scientifically developed and the equipment is designed for hard and continuous service in all military operations that experts can forecast.

TO DEVELOP NEW WORM DRIVE.

To develop a new worm drive the Multiple Worm Drive Axle Company has been formed in New York. J. R. Rowland is president, A. L. Kull vice president, Albert W. Chase treasurer and Myron F. Hill secretary. The axle is the invention of Mr. Chase and aims to effect change gear, differential and driving action by a simple arrangement of worm gears that will permit a low manufacturing cost. Test axles are being built and will be submitted to manufacturers for arrangements for production on a royalty basis.



Jeffery "Quad" Truck Chassis Equipped with Wireless Apparatus in the Service of the United States Signal Corps.

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TRUCK SALES HEAVY IN SOUTHWEST.

Unprecedented winter buying of both trucks and pleasure cars is reported from the agricultural districts of the southwest—the states of Kansas, Missouri, Oklahoma, Texas, New Mexico and Louisiana. This part of the country has benefited greatly because of the conditions of the last year, for the farmers there have received exceptionally high prices for their grain and other products.

The first three months of 1915 show an increase of 50 per cent. in the number of trucks sold there as compared to the same months last year. It is estimated that trucks valued at $300,000 have been delivered in Kansas and the western part of Missouri. Of this amount $65,000 worth of trucks have been delivered in Kansas City alone.

This activity during the winter months is unusual in that section. One dealer doubled his selling force and sold 49 trucks, while last year during the same time he had sold only nine. He has been in business seven years and except for the improvement in demand the conditions under which he worked were no better than they had been in previous years.

A considerable part of the increased business is for light trucks to be used for jitney service. The demand from the farmers for trucks, which is developing rapidly, is practically new. Numerous machines of one-ton type have been purchased to haul produce to the towns and haul back feed and other supplies.

Among the factors which, in addition to good crop prices, have brought about these sales, is the present low cost of gasoline and the high cost of horse feed. Horses are also scarce and high priced because so many have been shipped out of the country for use in the European war.

UNITED STATES RUBBER ELECTS OFFICERS.

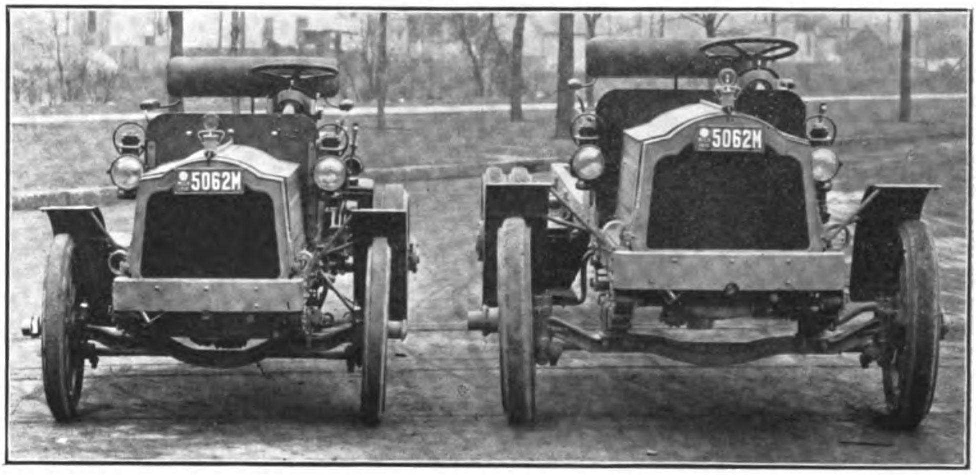
The following officers of the United States Rubber Company were elected at the annual meeting in March: President, Samuel P. Colt; vice president, James B. Ford; vice president, Lester Leland; vice president in charge of development work, Raymond B. Price; vice president in charge of footwear department, Homer E. Sawyer; vice president in charge of tire and mechanical departments, Elisha S. Williams; secretary, Samuel Norris; treasurer, W. G. Parsons; assistant treasurer, E. J. Hawthorne; assistant secretary, John D. Carberry. The executive committee was elected without change from last year.

PACKARD TRUCK DESIGNS.

In Appearance the Machines are Identical but Differ in Proportions.

The Packard worm driven trucks are constructed to one general design, and while the different capacity machines differ from each other in some details, the appearance of each is identical. That is, care has been taken to maintain the distinctiveness of Packard construction, and while this is evident enough to those who are familiar with the trucks, yet when there is opportunity for comparison the Packard character of each is impressed upon the observer.

In the new series of Packard trucks are six machines, the range being in tons capacity from one to six, and of these the smallest is a size never before built by the Packard company. The accompanying illustration shows a ton and a three-ton Packard truck side by side and head-on, and in everything but size they are exactly alike. The Packard company makes a statement that this small truck is the "star" of the line of maximum duty vehicles, and that it is equipped with all that is necessary to withstand the stresses of carrying its load at a relatively high speed.



Standardization of the Packard Motor Truck Design Demonstrated by the Appearance of the 2000 and 6000-Pound Machines Side by Side.

The capacity of the chassis is 3000 pounds, including the body, and it has a horsepower rating of 25.6 by the S. A. E. formula. Normally it is limited to 16 miles an hour, but when high speed is required it is limited to 18 miles, and when sold for special high speed the limitation is 20 miles, but these speeds must be approved by the transportation engineer. The standard wheelbase is 126 inches and the special wheelbase 144 inches. The motor is an L head type, with the cylinders cast en bloc, with a bore of four inches and stroke of 5½ inches.

The power plant is a unit type with the clutch assembled with the motor. The motor is fitted with an automatic governor that regulates the engine so that a predetermined vehicle speed is not exceeded. The carburetor is fitted with a hot water jacket and hot air

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intake to insure high efficiency from low-grade fuel. The cooling is by water circulated by a centrifugal pump through a cellular radiator independently mounted. The lubrication is by the Packard circulatory system that will afford satisfactory lubricity at all engine speeds. The ignition is a Packard-Bosch high-tension magneto, duplex system.

The clutch is a multiple disc type with hardened steel plates faced with asbestos fabric. The transmission gearset is a progressive sliding gear construction that has three forward ratios and reverse. The drive is by a shaft, worm and worm wheel to a full floating rear axle, the moving parts of which are operated in a bath of oil. The springs are semi-elliptic, the forward set being mounted under the frame and the rear set at the sides of the chassis frame. The service brake operates on the main driving shaft, is cooled by a fan and is equalized, and it has power to lock the wheels in normal operating conditions. The emergency brake shoes expand within large drums on the rear wheels, having overhead hinges to prevent rattle. The steering column is at the left side, the gear being a worm and wheel type with the worm and wheel forged integral with their respective shafts. The control levers are operated by the driver's left hand.

The claim is made by the Packard company that the centralized control and the general mechanical simplicity of the one-ton machine especially adapts it for service where the requirements are not large and the drivers are more or less lacking in experience. The design is such that extremely fragile freight may be carried without danger of breakage. The research work of the Packard company in designing the different machines it produces has been very exhaustive, and it is interesting to note that statement is made by the company that the one-ton truck is the result of the most rigorous forework it has ever undertaken.

LEWIS APPOINTED RECEIVER.

C. H. Lewis of Harpster, O., has been appointed receiver for the Ohio Tractor Manufacturing Company of Marion, O., upon the application of the Marion County bank. The bank seeks to collect on a chattel mortgage of $20,000 against the machinery in the plant. The Ohio Roller Sales Company, Ezekiel Brown of Morral and W. H. Bones of Marion are named in the bill as co-defendants. The total amount of the claims secured by a chattel mortgage is $58,000.

A student branch of the S. A. E. has been formed at Cornell university, Ithaca, N. Y., and at the first meeting there were 65 students present, more than 40 of whom applied for membership in the branch. It is expected that number will reach 100 before long. The following officers have been elected: Honorary chairman, Professor R. C. Carpenter; branch president, Lenox R. Lohr; branch vice president, P. K. Linsey; branch secretary, H. A. Knight; branch recording secretary, N. W. Suiter; branch treasurer, S. Dewsnap.

MAKERS OFFER 'BUS DESIGNS.

Three manufacturers, after a study of the jitney movement and the rapid increase in the use of motors for passenger transportation, have designed and are building special 'busses.

Among these is the Studebaker Corporation, which terms its 'bus the "Transportation Model." Mechanically it adheres to the standard Studebaker design, but greater strength has been added to various parts of the chassis to sustain the heavier loads it is built to carry. This is particularly true of the rear axle construction.

Fourteen passengers can be seated comfortably in the body of the car. Entrance and exit are effected by a front door only, so that it can be operated as a pay-enter with the driver collecting fares. The door is opened and by a lever operated by the driver. The car is lighted by electricity inside and out and sells for $1235 complete.

The H. J. Koehler S. G. Company of Newark, N. J., has built a 'bus of the pay-enter type with open sides on a Koehler truck chassis and is operating it in Newark as a jitney.

Practically all the heavy duty truck makers will build special trucks with passenger car bodies, or will supply the chassis and blue prints of a body that may be executed by a body builder.

MOTORS SAVE CHICAGO $90,000.

Savings effected in the operating expense of the Chicago fire department since motors were first installed to replace horses are estimated at $90,000. Still the department is only 22 per cent. motorized. Every preparation is being made, however, for the final retirement of the horse from the fire service.

New fire stations are designed without reference to keeping horses. And where it is necessary to assign horses to a new station the stalls are so arranged that they can be readily removed later on.

In addition to the large amount saved in actual operating expense, the efficiency of the department has increased and the losses sustained by property owners through fire has been greatly reduced.

SIX GASOLINE ENGINES FOR NEW YORK.

Fire Commissioner Adamson of New York City has placed an order for six new gasoline pumping engines for the fire department. These were purchased of a Cincinnati maker and the price for the six was $43,338. The six engines must be delivered in 100 days.

Outside of the high pressure district below 34th street, Manhattan, and in the business district of Brooklyn, where engines are unnecessary, all the engines will eventually be of the gasoline type. The engines just ordered will be used to equip companies which are just being organized.

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EUROPEAN ARMY MOTOR EQUIPMENT.

MILITARY authorities seem agreed that after the present war tactical text books, the world over, will have to be rewritten, so much that is new and opposed to previous theories and practise has eventuated during the past few months on the great battlefields of Europe. But in no direction have these developments been more interesting or of more importance than in the substitution of the motor truck and the motor car for the animal drawn conveyance or animal for military purposes. Transport of supplies and ammunition, which, owing to the large number of men involved, and the prodigious rate with which modern field guns must be served, has been a problem of great magnitude, which has been met to a very large degree by the motor transport.

While this is, and probably will be, the principal use made of the motor vehicle in war, many special uses of it have been made, some of which are more interesting, if less important. Armored trucks have carried large guns into action, armored cars with machine guns have aided and to some extent replaced cavalry, and motor ambulances are the mainstay of the medical departments. The commissary departments have in many instances motorized the field kitchens, greatly increasing their radius of action and multiplying the number of men that can be served by these equipments. The signal departments have used specially equipped vehicles to carry field wireless, and the artillery has used trucks rigged to elevate its observers to a point where they could view the field clearly and observe the effect of shots and correct ranges.

It is little exaggeration to say that every mail from Europe brings a description of some new and ingenious use of motor vehicle in the grim business of war.

MILITARY OBSERVATION CARS.

Among the new uses of motor vehicles is that of field observation. The method consists not in using the speed of the motor car for scouting—although, of course, it is used in that way also—but of mounting upon it equipment by which observers can be raised to heights from which the battlefields may be surveyed.

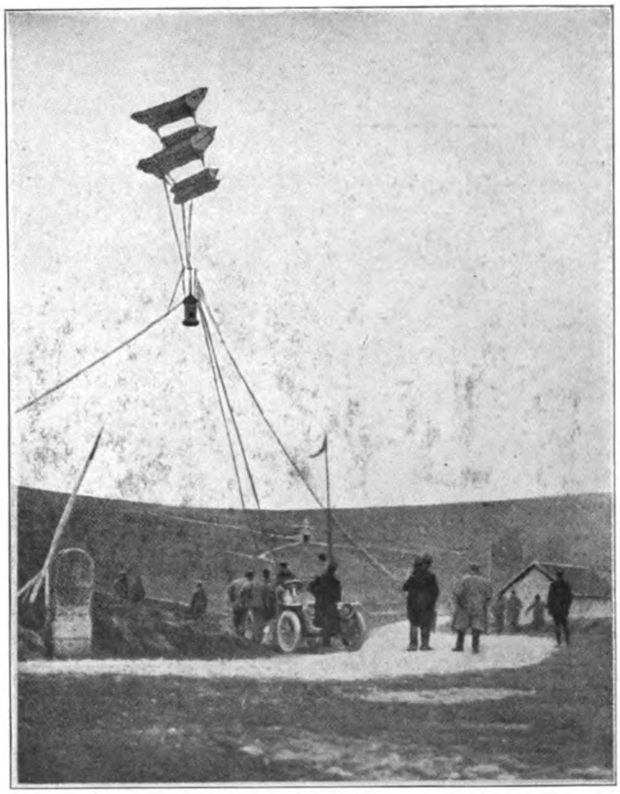
A plan used by the Germans from the beginning of the war is to equip a car or truck with extension ladders similar to those used by fire departments. The observers are perched on the top rungs of the ladders, raised to a height of about 35 feet above the ground. The apparatus is limited in service, since in many instances a height of 35 feet is insufficient for satisfactory observation.

The French have developed a system that is of far greater practical use and is much more picturesque in service. They equip a field observation car with a series of man lifting kites, which will take an observer to a much greater height, so that his work is much more effective.

For the creation of this system Commandant Saconney is given credit. A motor truck with power to haul a light trailer is required. The car and trailer afford space in which an observation crew and the necessary equipment can be carried.

When an observation is to be made the first series of kites is sent up, and to these is connected a wire rope, which forms a temporary aerial ropeway, upon which can be run, on a large trolley wheel, a basket car, in which the observer can ride.

The basket car is drawn up by the second series of kites. Both series are controlled by the motors of the truck, which are rigged to turn over winding drums mounted on the truck decks. This apparatus is similar to that used for observations with captive balloons. With the truck engine operating a winding drum, the cable which holds the kites can be drawn in at a rate of about 600 feet per minute.



French Military Observation Motor Car Operating Its Kite Equipment.

This has two advantages. The observer can be quickly drawn down out of danger in the event that the enemy concentrates its fire upon him; or if the wind should cease suddenly it makes it possible to concentrate enough air pressure upon the planes of the kites—through the speed at which they are drawn toward the truck—to hold the kites steady and prevent the observer from falling at a rate dangerous to his safety.

The machine used with this type of equipment in

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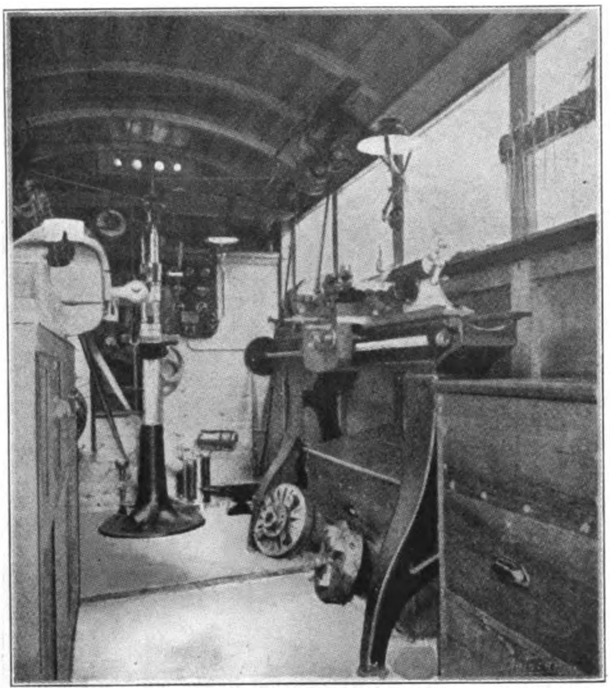
the French army is a 24-horsepower Delahaye, weighing, when loaded, about two tons, and carrying a trailer having a load capacity of 2500 pounds. The average speed of the vehicle on the road is from 12 to 15 miles an hour.

MOTOR HAULED REPAIR SHOP.

So many motor vehicles are in use in the European war operations that the question of repairs on the field has received great attention from the engineers of all the armies. The British Red Cross, which has hundreds of ambulances in use in France, has provided a number of compact, but surprisingly complete repair



View Showing the Interior of Motor Repair Shop and Machinery.

shops, mounted on motor trucks that can be driven rapidly from place to place.

The field shop contains the most essential machine tools. At the forward end of the chassis is a 2½-horsepower gasoline engine, which is used to drive overhead shafting by a belt. On the left side is a 6½-inch centre screw cutting lathe with a six foot bed. It has a hollow head and is equipped with an expanding mandril and all necessary chucks.

At the front of the compartment is a vertical drill press that will drill half-inch holes. There is also a double emergency grinder equipped with wheels for both rough and finish grinding. A dynamo charges storage batteries and lights the interior of the repair shop at night, and an acetylene lighting system is provided for use if electrical equipment fails.

A blacksmith's forge with all the necessary tools and a powerful gasoline flame for heating is included. A strong bench is fitted with a vise and with drawers and a cupboard for small tools. That the mechanics can work long pieces of material in the vise the end of the body is made so that it will drop down out of the way.

A hood is attached to the back of the car to protect the workmen at a rear bench, on which oily and dirty jobs are worked. The shop carries a derrick of special construction by which either end of an ambulance may be raised off the ground for repairs. Or if desired the end of a damaged ambulance may be raised from the ground and the car towed—running on its remaining wheels—to a place where it is possible to complete the repairs.

FRENCH ROADS WORN OUT.

The tremendously heavy and almost continuous traffic of all sorts of vehicles upon the French roads to and from the battlefields has practically worn them out and broken down the splendid surfaces which were the delight of motor tourists before the war. In addition to this, the almost continuous rain which poured during January and February, has made traffic very difficult.

Owing to these conditions the French army officers have found the lighter sizes of trucks of more use for transport purposes than the heavy duty types, and many factories in England and France are said to be concentrating their production of light trucks for army use.

Meantime, detachments of the French territorial army are busy rebuilding the roads as rapidly as possible and with dry weather it is likely they will very soon be in fairly good condition.

The Germans, meeting similar conditions, found the caterpillar drive tractors with which they moved their heavy artillery early in the war, of great service. Before the war these machines were used largely for agricultural purposes.

WAR RESTRICTIONS IN ENGLAND.

Operators of motor trucks and motor cars in England have been experiencing difficulties through the special regulations enforced in many parts of the island regarding lights at night. These restrictions are the result of the general apprehension of the presence of German spies and the fear that lights shown at night might attract the unwelcome attention of raiding Zeppelins—dirigible ballons.

The regulations that have been causing difficulty include also the erection after nightfall on various roads of unlighted barricades, and the frequent examination of licenses by the police. These are not the same in every part of the country and are varied every day by the authorities according to necessities, so that it is impossible for an owner to know what may be expected and conform to the requirements. The only advice the London motor papers can give their readers is to keep off the roads after dark.

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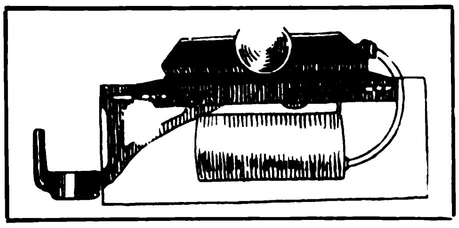
MOTOR TRUCK ACCESSORIES AND EQUIPMENT.

MALCO ELECTRIC TAIL LIGHT.

Equipment Especially Adapted for Truck Service That Is Operated from Dry Cells.

All state motor laws require that each machine be equipped with a rear light that will illuminate the registration plate and also show red to the rear. While some communities are indifferent in enforcing this law, there are many that compel the full observ- statutes. The Malance of the ton Specialty Company, 755 Boylston street, Boston, Mass., is manufacturing an electric rear light that will meet all legal requirements. This device has qualities that should impel the attention of truck operators who experience difficulty in keeping tail lamps lighted. It will fit any number holder or it can be attached to the body of the car.



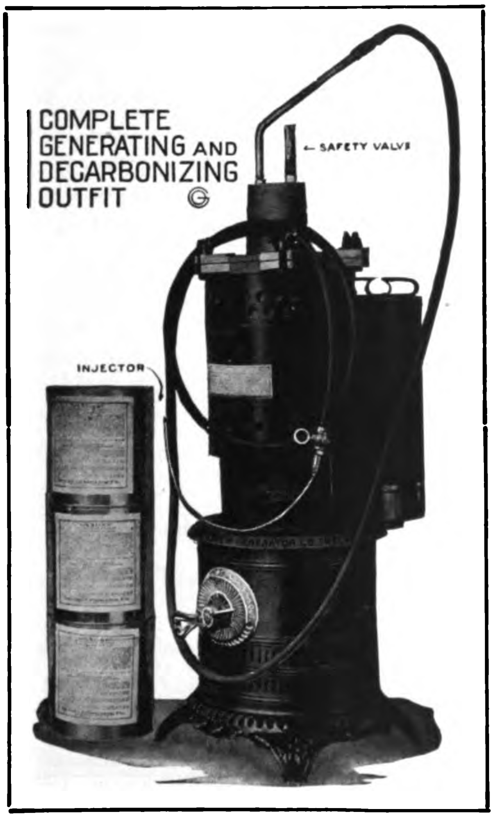
Malco Electric Tail Lamp.

The lamp is 9½ inches in length, and has a silver plated reflector, which projects a strong light on the number plate. An intensifying glass is fitted into the base of the light, which protects the interior from mud and water. The current is furnished by a battery of two dry cells, which is in a strong case under the body. Two ordinary cells will supply the energy for this light for 95 consecutive hours. The lamp is finished in black and nickel and retails complete for $3.50. The tail light may be secured separately if desired with a six-volt Mazda light for $2.75.

OXYGEN DECARBONIZER.

Equipment Adapted for Cylinder Cleaning in Private and Public Garages and Service Stations.

Those experienced in gas engine use are agreed that the most certain means of removing carbon deposits from cylinders is by burning with oxygen, which work can be done without removing the motor from the chassis, and the time required is very short in comparison with scraping or saturation, and the removal is thorough, even from the parts of the cylinders that are inaccessible to tools.



Oxygen Decarbonizing Outfit.

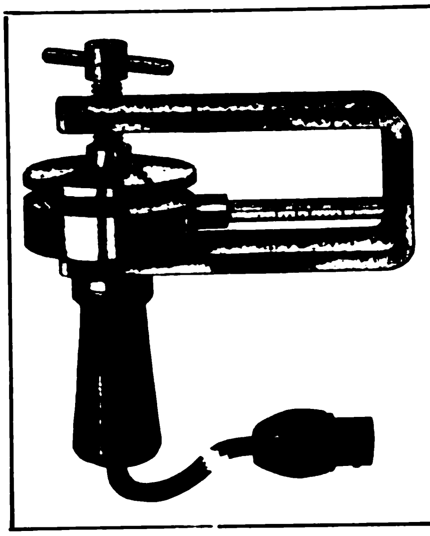
The Oxygen Generator Company, Inc., 301 River street, Troy, N. Y., is manufacturing a complete generating and decarbonizing outfit that is specially desirable for vehicle owners, as well as for garages and repair shops. This equipment has many advantages, one of the most satisfying of these being the fact that the outfit generates its own oxygen. By placing one four-pound can of oxy-gas in the cylinder and lighting the burner under it, enough gas can be generated in three or four minutes to thoroughly clean four heavily carbonized cylinders.

The apparatus is strongly made from heavy cast iron and stands 2½ feet in height and 9½ inches in diameter. This device will store oxygen gas for many weeks and as it is fitted with a safety valve, it cannot explode. A long injector for placing in the cylinder is attached to the end of an exceptionally well made hose. The utility of the apparatus is evident, for it is extremely economical to operate, it minimizes labor, does the best of work and it can be used constantly by garages and shops that have motor work. As an equipment it has much to recommend it. Detailed information can be obtained by addressing the company. The generating and decarbonizing outfit is offered to the trade for $15 complete, with three four-pound cans of oxygas.

CORDECO ELECTRIC VULCANIZER.

Equipment That Can Be Operated from Any Six-Volt Battery or Lighting System.

Vulcanizing is the only proper method of repairing tires. When a repair has been made with an ordinary patch, the heat from the road friction will many times so soften the cement that the patch will peel off. When a repair is made by vulcanizing, a piece of raw gum is cured by heat and becomes part of the tire itself and it cannot be torn off or loosened. This kind of a repair will generally give long service.



Cordeco Electric Vulcanizer.

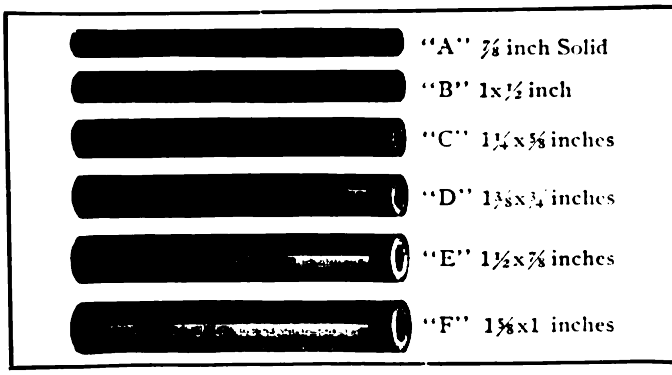
A valuable equipment can be used on any car that is equipped with electric lights, in the form of a six-volt electric vulcanizer made by the Corbett & DeCoursey Company, Pittsburg, Penn. This vulcanizer, which is listed in the trade name of Cordeco, is operated from any six-volt storage battery. A six foot cable makes this device portable to any tire and by removing any light bulb and inserting the plug in its stead, enough heat can be developed in five minutes to successfully vulcanize any patch.

The manufacturer states that rain, cold or wind will not hinder this device in its operation. A heat gauge, which is clearly shown in the illustration, registers the number of degrees of heat that are being developed and the temperature can be regulated to meet the requirements. The price of this vulcanizer is $5 and is sold with the guarantee that should the heating element of the Cordeco burn out when used on a six-volt circuit, or become impaired through the use of defective parts within a period of five years, the company will repair it free of cost. The complete outfit consists of a heavy canvas carrying case, a chain for attaching the vulcanizer to the outer casing, a sheet of Para rubber and other materials sufficient for 25 ordinary tire repairs.

NON-GRAN CORED BRONZE BUSHING.

Assortments of High-Grade Bearing Material Supplied in Standard Sizes to Meet Shop Requirements.

The American Bronze Company, Berwyn, Penn., is now producing for the trade of dealers and repair shops a special assortment of its Non-Gran cored bars for bushings. The sizes



The Sizes in the 6-54 Assortment.

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included will make bushings for any shaft diameter up to $1\frac{1}{4}$ inches. Six of the bushing bars which this company manufactures is shown in the accompanying illustration. This set is known as the 6-54 assortment. By using these bars the repairman will require less stock and minimize the waste of metal that is now necessary with other material, because Non-Gran is very fibrous and contains no blow holes. The assortment illustrated is not expensive, a special price of $9.69 being made to the trade, which averages $47\frac{1}{4}$ cents a pound.

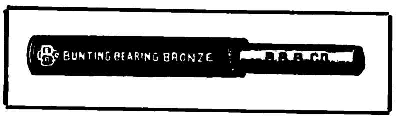
Non-Gran Assortment Boxed.

The company has also established new low prices on standard and near standard sizes of Non-Gran cored bars. Through economical manufacturing the company is able to offer these bars to the trade at the rate of $52\frac{1}{2}$ cents per pound. This is the net price as the list is 75 cents. A 30 per cent. discount has been made on all standard and near standard sizes, which brings the price down to $52\frac{1}{2}$ cents. The six bars in the 6-54 assortment make 54 standard and all intermediate sizes, hence the name 6-54. A set of these cored bars is a valuable stock to any repair shop, and when purchased the company will furnish a poster which states that Non-Gran Cored Bars are used for bushings. By addressing the American Bronze Company, department M, the dealer, jobber or the repairman will receive full details of the company's stock, prices, discount, etc.

BUNTING BEARING BRONZE.

Cored Bushings That Largely Economize Material and Labor Produced to Meet General Requirements.

The Bunting Brass and Bronze Company, 727 Spencer street, Toledo, O., is manufacturing cored bronze bars for making bushings and bearings. These bars may be secured in 12-inch lengths with outside diameters from one to $4\frac{1}{2}$ inches. The inside diameters range from $\frac{1}{2}$ inch in the one-inch bar to $3\frac{1}{4}$ inches in the $4\frac{1}{2}$-inch bar. The company lists these cored bars according to size by letters and sells them according to weight. These bars are cast very near required dimensions and their use means the saving of material and economy of labor when machining to the standard size. Bunting Bearing Bronze in cored bars is sold by most jobbers, or it may be procured direct from the factory. Information of this material can be obtained from the company.

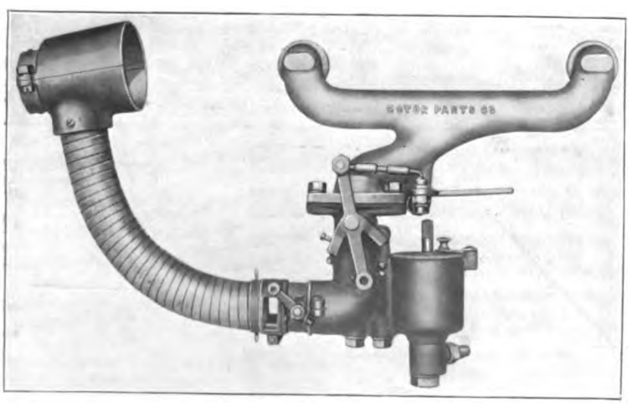


Bunting Cored Bearing Bronze.

MODEL 04 ZENITH CARBURETOR.

Special Type for Which Strong Claims Are Made That Is Designed for Ford Chassis.

The Motor Parts Company, 818 North Broad street, Philadelphia, Penn., is now producing for the trade a carburetor that is specially adapted to Ford cars. Like all the Zenith carburetors, this carburetor is characterized by a compound nozzle which gives more speed, more power and more economy than is possible with the ordinary type of carburetor. The compound nozzle also allows the motor to run smoothly at all altitudes without adjustment.



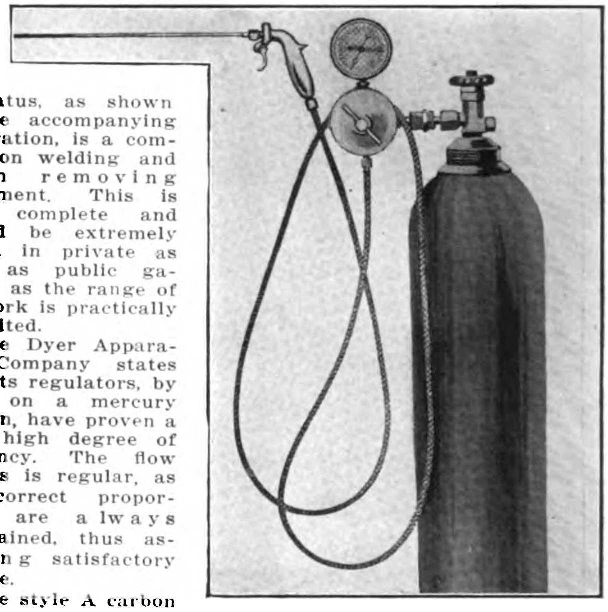
Model 04 Zenith Carburetor.

The Zenith carburetor is simplified to such an extent that there are no accessible adjustments which may be tampered with. It is claimed that the carburetor is made with the same care that is taken in making a watch, as every part is interchangeable and thoroughly inspected. This carburetor should give a lengthy service, as it is very strongly constructed and has no moving parts. The outfit, which consists of one Model O4 one-inch Zenith carburetor, one special manifold hot air drum and tube, and all necessary gasoline and throttle connections, retails at $20. Most dealers carry this carburetor in stock, but if they do not, it may be secured direct from the factory.

DYER WELDING OUTFIT.

Combination Apparatus Designed for General Use in Garages and Repair Shop.

Among the many welding and decarbonizing equipments produced by the Dyer Apparatus Company, Cambridge, Mass., is a complete outfit, which the company lists as Style A. This apparatus, as shown in the accompanying illustration, is a combination welding and carbon removing equipment. This is very complete and should be extremely useful in private as well as public garages, as the range of its work is practically unlimited.



Dyer Welding and Decarbonizing Outfit.

The Dyer Apparatus Company states that its regulators, by tests on a mercury column, have proven a very high degree of efficiency. The flow of gas is regular, as the correct proportions are always maintained, thus assuring satisfactory service.

The style A carbon removing outfit is a high-grade, popular priced apparatus. The regulator is a diaphragm type and is made of phosphor bronze with a hard rubber seat, and is designed for high pressure. A double connection is used at the tank end, fitting either the standard Linde tank or the $\frac{3}{4}$-inch straight thread that is sometimes used on oxygen tanks.

The gauge will indicate a pressure as high as 150 pounds and is fitted with a bevel glass. The hose is of the best grade, having a woven linen cover, and is tested to high pressures. Couplings are provided at each end, making for easy assembling and disassembling.

The torch should be an object of special attention. The drop handle attaches to the hose in a natural manner that prevents wear or breakage at this point. The trigger valve is instantaneous in action, so that the gas can be immediately turned on or off as desired. The injector is made of flexible copper tubing, which is a decided advantage to the operator. The maker states that an extra long injector will be supplied when desired for the removing of carbon in mufflers.

Detailed information of these oufits will be supplied to those addressing the company. The Dyer Apparatus Company also invites the trade to visit its plant, which is one of the largest welding shops in New England.

MANUFACTURERS' PUBLICITY DATA.

Information Intended for This Department Should Be Sufficient and Accompanied by Illustrations.

This department is to bring to the attention of the readers of Motor Truck what is new and useful in motor wagon and truck equipment, accessories and supplies, that they may be informed of what is added to the market, and have knowledge of the utilitarian values. The number of pages will be necessarily limited and the subjects dealt with must be briefly reviewed to serve the largest number in the space available. So far as is possible illustrations will be made and prices will be given, and the addresses of the manufacturers or selling agents. That this information may serve the best purpose of all interests, request is made that data covering productions of any kind be sent to this office, addressed to the Automobile Journal Publishing Company, accompanied by cuts, if possible. No cut should be more than $3\frac{1}{2}$ inches width, and the screen should be the standard 133. When cuts are not available photographs should be sent and of a character that will insure satisfactory cuts.

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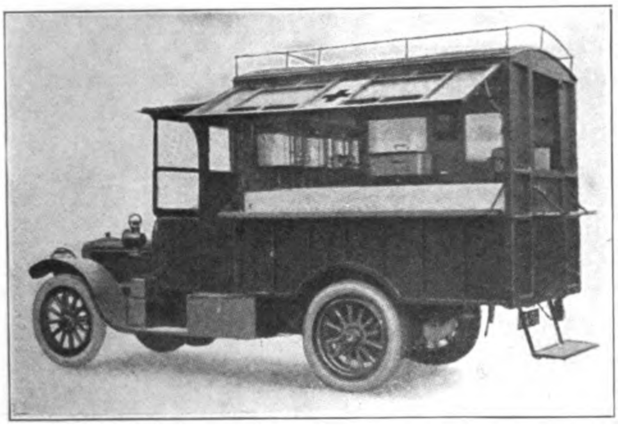
MOTOR FIELD KITCHENS AND HOSPITALS.

ONE use of motor vehicles which is general with the commissary departments of the European armies, is for field kitchens. These are built with closed bodies, somewhat resembling vans, but fitted with windows at the sides and rear. One side of the



English Built Field Kitchen Mounted on Daimler Chassis, Showing Side Lowered.

body can be opened on hinges. The lower half drops and when opened it resembles a lunch counter.

Food can be served on this shelf from the kitchen inside and can be removed without entering the body. The upper half of the body side wall is lifted and serves as an awning, protecting the food on the serving shelf.

The equipment of the kitchen consists of two duplex cooking ranges, and there are four boilers for soup or stews. There are also three single stoves with boilers for hot water. Two water tanks, each of 19 gallons capacity, and an aluminum sink, are also provided.

This body was built upon the chassis of an old chain driven Daimler by James Young & Co., Ltd., of Bromley England, and was delivered to the French Red Cross.

A larger type of field equipment in use by the English Red Cross is known as the Whiting-Federal kitchen. This is mounted on a Federal two-ton truck chassis imported from America.

The inside dimensions of the kitchen are nine feet long, five feet four inches wide and seven feet high. The cooking stove is at the forward end. It is heated by kerosene and carries a large water boiler and receptacles for hot milk, meat extracts, soup and the like. There is a water supply for making tea, coffee, cocoa and for other purposes.

Exterior View of Federal Truck Equipped as a Field Kitchen in British Army.

The water is carried in a 60-gallon tank installed in the roof of the body over the driver's cab. This tank is placed almost immediately above the stove and near the flue, so as to prevent freezing of the water in very cold weather. The tank is fitted with a Wilcox rotary pump for drawing water from any supply that may be available. Inside of the tank is a filter, through which all water used is drawn. Electric lights illuminate the kitchen at night and windows in the sides light it during the day.

The equipment includes a sink with the necessary fittings and a cold water supply, 18 drawers for food and cutlery, and four substantial cupboards for general supplies. This kitchen is designed to serve 500 hot meals in 12 hours.

This and other special apparatus supplied to the English government by the Federal Truck Company and its London representatives have been used with excellent results at the front.

A Red Cross kitchen on a Ford touring car chassis has also been fitted by a firm of London body makers and delivered to an English girl, Miss Betty Hutch of Hampton-on-Thames, who proposes to show her patriotism by driving it at the front. The interior of the car is fitted with four large steam cookers, which are heated by pipe connections to one central boiler.

FRENCH MOTOR OPERATING ROOM.

An interesting equipment of the French military medical service is a completely equipped surgical operating room carried on a large Schneider truck chassis. Before the war this chassis was used as a 'bus in Paris. It has been fitted with an exceptionally long body, which is divided into three spacious compartments.

The larger compartment is in the centre of the car, which is fitted with an operating table and a complete X-ray equipment. One of the small compartments contains an apparatus for the purpose of sterilizing water by the use of the ultra-violet ray, while the third contains the instruments and supplies necessary in

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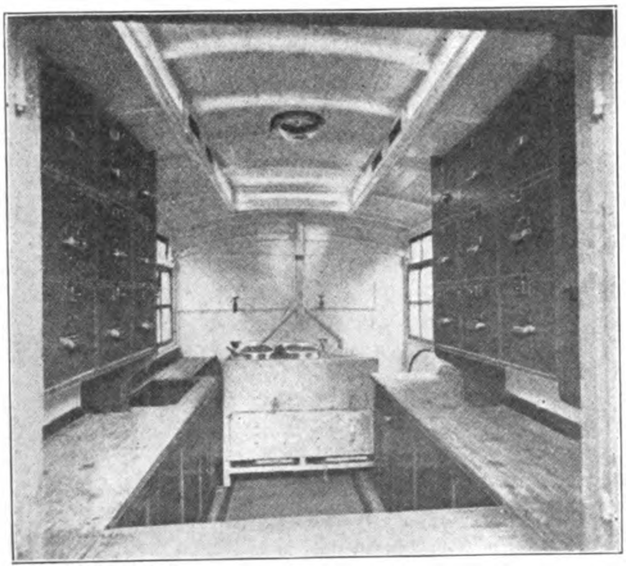
surgical work. On each side of the vehicle is a folding tent, which can be opened to cover spaces for injured men, each sheltering an area of about 20 square yards.

GERMAN MOTOR AUXILIARIES.

With the advice and assistance of the Benz engineers the German army has worked out some interesting auxiliaries which are equipped with everything necessary to resupply army cars in the field and make any emergency repairs that may be necessary.

These repair shops are mounted on Benz chassis and the body is designed to fit the particular use to be made of it. There is, for instance, a motor driven tank wagon, used to carry fresh supplies of water, gasoline and lubricants to the motor vehicles in active service. The front and rear compartments contain the oil and water, while the larger one in the middle is given over to gasoline. Each section is fitted with a



Interior View of the Federal Field Kitchen, Showing Equipment.

gauge glass and a pump, by means of which the contents can be forced through flexible hose to tanks that need refilling.

Another auxiliary has been especially designed to carry a complete stock of replacement parts, and in addition to minor parts such as screws, springs and spark plugs, it carries new tires, rear axles, transmission gearset, etc. The larger parts are piled together in one large compartment and the smaller ones are kept in bins.

Another special machine has been equipped for hauling away a damaged vehicle to prevent its capture by the enemy. This truck has exceptionaly long wheelbase and a frame to take an extra long platform body. The body is fitted with a folding truss, which can be used as a runway on which a chassis can be hauled onto the platform by a capstan. The capstan is driven by the truck engine. The platform is fitted with a crane which can be used to lift a machine when it is not practicable to run on the platform by its own wheels.

A machine shop on a motor truck for keeping both vehicles and aeroplanes in operating condition is another important equipment with the motor division of the army. When in motion this car resembles a van, but the sides open along a horizontal line in the middle, so that when opened the upper half is as an extension to the room and the lower half to the floor, greatly increasing the amount of space in which the mechanics can work. A gasoline engine drives overhead shafting, from which a series of automatic machine tools is operated.

FRENCH MOTOR FIELD HOSPITALS.

The French army at the initiative of Dr. Hallopeau, has fitted a number of fleets of motor vehicles designed to carry field hospitals about the battlefields. Each of these fleets consists of three motor cars and a truck. The cars are used to transport the necessary equipment for the erection of large tents in which the field hospitals are established.

In the truck is carried surgical apparatus and a large steam generator, from which it is possible to obtain quickly large supplies of hot water with which wounded men can be washed thoroughly before they are given attention by the surgeons. This arrangement makes it possible to establish an efficient field hospital very close to the fighting line, so that wounded men need not be transported far before receiving medical attention.

MOTORS TRANSPORT SEARCHLIGHTS.

In night fighting along the trenches in the European war the searchlight has been constantly used. The lights afford such protection that surprise attacks in the dark are practically an impossibility. In case of a serious assault at night it is as important for defenders to concentrate their searchlights upon the threatened point as it is to concentrate the fire of their guns. To secure the greatest mobility for their lights the French have mounted them on motor chassis so that they can be rushed from one point in the line to another with the greatest possible speed. The largest type of naval searchlight is used and this is carried on a stiff angle steel bracket bolted at the bottom of the frame of a motor truck chassis. The light is about five feet above the deck of the machine.

"Good Roads Day" has been set for May 2 in Pennsylvania, and it is expected that more than 500,000 volunteer workers will turn out to improve the highways in the 67 counties of the state. In Blair county alone, 20,000 men have signified their intention to co-operate in the movement. Automobile and civic organizations are taking great interest in the movement.

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., MAY, 1915 No. 5

VOTE TO STANDARDIZE OWNERS' SERVICE.

Convention of Motor Truck Manufacturers Names Committee to Determine Detail of Policy for Guidance of Industry, and Votes to Adopt the N. A. C. C. 90-Day Warranty—First General Meeting of Interests Very Successful.

MEETING on a common level and frankly discussing their problems, the delegates to the convention of motor truck manufacturers, held at the Hotel Statler, Detroit, Mich., organized by the National Automobile Chamber of Commerce, Inc., and directed by the commercial vehicle committee of that association, seemingly reached an understanding as to the needs of unity and co-operation, and adjourned after appointing a committee that will draft a report on a service policy for the industry for presentation to a convention to be held not later than October.

The convention was attended by the representatives of 56 different concerns building motor vehicles, the number of registered delegates being 128, and of these a considerable portion were not affiliated with the National Automobile Chamber of Commerce. A general invitation had been extended to the manufacturers of motor trucks and wagons to be present and participate in the deliberations of the convention, and those who accepted who were not members were solicited to express their opinions freely that as broad an understanding as to policies as was possible might be reached.

Col. Charles Clifton, President, National Automobile Chamber of Commerce.

The principal result accomplished was the appointment of a joint committee of 10, with five members representing the National Automobile Chamber of Commerce and five representatives of those unaffiliated, who were designated as the Independent Makers' Service Committee, to consider a general policy of service to owners and submit a report at a convention to be called in the early autumn. But in addition to this the convention discussed the proposition to hold exhibitions, and decided, after unlimited consideration, not to indorse indoor shows, and rejected the suggestion that outdoor demonstrations might be substituted for the hall displays.

Participation in the Activities.

The delegates listened with much interest to the presentation of opinions as to the desirability of selling machines for deferred payments, and the experience of several appeared to justify that a selling policy that would make possible the sale of trucks and wagons to those who could not afford to make cash purchases, but no determination was reached. The prevailing belief was that this was a subject that should be maturely deliberated, because of the business ramifications that might obtain, and for that reason no conclusion was reached by the convention. The proposal to dispose of vehicles for time payments undoubtedly appealed to many of those in attendance, and without question it will be further considered at future meetings of like character.

The convention afforded an opportunity for the delegates to meet and to know each other; to talk frankly of business subjects and relations in which all had common concern with the belief that whatever was said or done was for the benefit of all, and to stimulate and promote a spirit of unity and co-operation in all things that will be to the advantage of those engaged in the industry and those who shall purchase and use its products.

First General Convention.

This was the first meeting of manufacturers of trucks and wagons, which was open to all without regard to organization, and the prevailing belief was that the industry was of such proportions that it

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Windsor T. White, President, the White Company.

W. L. Day, General Manager, General Motors Truck Company.

Vernon Munroe, President, International Motor Company.

should have the benefit of concerted promotion. This was not in the nature of criticism, but was a decided unanimity of opinion that the firms and companies ought to have the decided benefits that obtain from organized endeavor, and policies that will be understood by the public generally. There was a prevailing opinion that future conventions would attract to them the representatives of manufacturers who will indorse the attitude of the delegates and approve the principles that were advocated.

In addition to the subjects stated the convention listened to the presentation of a number of decidedly interesting papers on subjects of material importance, which had been carefully prepared and which were discussed to considerable length. The consideration of these topics was fruitful, because of the fact that all delegates were more or less concerned, and there was free expression of opinion that had been developed from experience and was of value from the viewpoint of a business man.

Organized by N. A. C. C. Committee.

The convention was directed by the commercial vehicle committee of the National Automobile Chamber of Commerce, of which Windsor T. White is chairman, and with whom are associated Alvan Macauley, H. Kerr Thomas, P. D. Wagoner and M. L. Pulcher. The morning of the first day, from 10 until 12:30, was given over to a meeting of the directors of the N. A. C. C., which was followed by a "Get-acquainted" luncheon.

The first business session was opened at 1:30 by Hugh Chalmers, president of the Chalmers Motor Car Company, who maintained that co-operative competition will be the key note of good business in the future, and who believes that the time is past when business competitors should regard each other with suspicion, for business men have found that through co-operation is commercial and industrial activity best promoted.

At the conclusion of Mr. Chalmers' remarks, Windsor T. White, chairman of the commercial vehicle committee of the N. A. C. C., was chosen chairman of the convention, and the first business was the consideration of the subject, "What Can Be Done to Improve Conditions in the Truck Business?" which was opened with a paper read by John W. Van Allen, president of the Atterbury Motor Car Company, Buffalo, N. Y., and which was followed by discussion led by F. J. Trudell, president of the D. F. Poyer Company, Menominee, Mich.; M. L. Pulcher, vice president and general manager of the Federal Motor Truck Company, Detroit, Mich., and J. C. Millman, secretary-treasurer of the Stegeman Motor Truck Company, Milwaukee, Wis.

A paper on "How Can Physical Problems That Militate Against Economical Use of Trucks Be Solved?" by David Beecroft of Commercial Vehicle, was next read, and the discussion followed was led by A. B. Cumner, New York service manager, the Autocar Company, and J. W. Brown, general manager, the Couple-Gear Freight Wheel Company, Grand Rapids, Mich., and was of material interest.

The Used Truck Problem.

The third subject of the afternoon was "How Can the Used Truck Question Be Handled?" a paper by W. L. Day, general manager of the General Motors Truck Company, Pontiac, Mich., with discussion which was participated in by H. H. Hills, sales manager, Packard Motor Car Company, Detroit, Mich.; Victor L. Brown, president, Sternberg Motor Truck Company, Milwaukee, Wis., and H. E. Wilcox, vice president, H. E. Wilcox Motor Company, Minneapolis, Minn. Mr. Day's belief was that the motor truck did not as a merchandising proposition differ from any other, and that there was no reason why a truck owner should not dispose of it as he would any other property, where he could obtain the best price; that he could not expect the manufacturer to pay a price to relieve him of what had possibly served its usefulness, and had no value to him.

Mr. Day's summary of experience developed some especially interesting comment. Mr. Hills believed that were Mr. Day's suggestion followed this would not effectually dispose of the proposition, for through varying conditions, all of which were legitimate, machines might be offered for sale, and re-

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fusing to take them in trade would not change the aspect of the market. He was convinced that machines would be sold for exceedingly satisfactory reasons, and he believed that the manufacturer or agent could consistently serve as a selling agent without having direct interest in the transaction, or by accepting a partial valuation as part payment for a new truck and paying the customer whatever might be realized from the sale of the used truck in excess of the valuation.

A Clearing House Plan.

Mr. Brown suggested a clearing house plan for the fixing of standard valuations of used trucks to insure against illegitimate buying or excessive prices being allowed by salesmen, and maintained that this plan could be consistently adopted by the N. A. C. C.

Mr. Wilcox pointed out the results from excessive allowance by competing salesmen who believed they might realize from the public knowledge of a change of a purchaser from one make of machine to another, especially with fleets, in which the manufacturer or agent is the loser. He believed that most purchasers could well retain their machines for extra vehicles, and the chief reason why they did not was the large allowance made in trade. He believed in a rebuilding department, separate from a factory, which could purchase used machines and restore and deal in them as a separate business proposition.

Alfred Reeves, General Manager, National Automobile Chamber of Commerce.

The Result of the GMC Policy.

In reply to Mr. Hills' comment, that Mr. Day was a manufacturer and that the problem was largely that of the dealer, Mr. Day replied that the policy of his company was extended to all of the branches of the company with equal success. Mr. Macauley believed that the number of used trucks was too small to justify a clearing house plan of disposing of them, although he thought the plan might be eventually adopted, but Mr. Pulcher suggested that there would be benefit if the manufacturers advocated the proposal and took such means as were necessary to bring about the adoption of the plan. General Manager Alfred Reeves described the operation of the central market report system the vogue with Chicago dealers in used passenger cars, and Chairman White stated that these reports served as guides to relative values and the prices were not final.

Mr. Brown believed that the prices obtained by owners for their machines would probably be lower if reports were considered; that the sales were often made by purchasing agents whose ability at trading was superior to the salesmen. Mr. Wilcox stated that the clever buying of the purchasing agents was generally inducing manufacturers to bid against each other. Mr. Pulcher commented that the demand by many owners of chain driven machines for worm drive vehicles might, in his opinion, result in greater number of changes than the industry had ever experienced during the present year. Mr. Brown stated that there was just as much reason to sell used trucks for standard prices as used typewriters, and there was abundant evidence that the prices for the latter were standardized.

M. L. Pulcher, Vice President and General Manager, Federal Motor Truck Company.

The Standard of Service.

The closing paper for the afternoon was "Can Manufacturers Have a Standard Service Policy?" by Alvan Macauley, vice president of the Packard Motor Car Company, and this was discussed at considerable length. Henry Lansdale, vice president of the Denby Motor Truck Company, maintained that the absence of a standard service policy resulted in loss for the dealers, and the salesmen frequently abuse the policies of the dealers with reference to service to obtain orders. The dealer eventually found that the profit that was figured in the salesroom was lost in the service station. This condition would be greatly changed by the adoption of a standard policy for all of the industry.

Mr. Day stated that since Jan. 1, 1914, buyers of GMC trucks have not received free service, but they have received better service. The policy of no free service was productive of more satisfying returns and the agencies and the branches were profitably operated. The GMC trucks are now sold for lower prices than would be possible with the former policy, and there was a

James L. Geddes, President, Kelly-Springfield Motor Truck Company.

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John Squires, Secretary, Signal Motor Truck Company.

Alvan Macauley, Vice President, Packard Motor Car Company.

William E. Metzger, Argo Electric Vehicle Company, of Reception Committee.

possibility of a still further reduction. He held that the policy outlined by Mr. Macauley was not equitable in that it discriminated against the truck owner who was not near to the service station. He believed the service gratis for a year and a guarantee of only 90 days to be inconsistent. He maintained that a real inspection would require eight days, which would mean a careful examination of all parts of the machine, dropping the crankcase, looking into the condition of the cylinders and the valves, and opening the gearset case and the differential housing. He also held that if the owner knew that without expense his truck would be examined and reported on once a month with reference to needed repairs, and if he could have all the minor adjustments made that were practicable in three hours, there would not be an incentive to give the machine the daily, weekly and monthly attention that it should receive. If there was a mishap, and the inspector had not warned the owner of the condition following an inspection, Mr. Day believed that an owner could legally compel the dealer or branch to assume the cost of repair and the loss of time of the machine. He was firmly of the opinion that no further service standardization was necessary other than the adoption of and rigid adherence to the standard warranty of the National Automobile Chamber of Commerce. If so large a part of the purchase price of a truck was required to give free service, the prices of trucks would remain high, because the cost must be added to the list. He also stated that his company had doubled its truck business since it had adopted the policy of no free service, and told of a service station which had lost money constantly each month until the policy was changed, and when this station was sold to an agent, and operated without free service, it made money as consistently as it had previously lost it.

Industry Not Ready as Yet.

Chairman White stated that Mr. Day's plan was ideal, but the time was not propitious for all manufacturers to adopt it. The policy that had been outlined by Mr. Macauley was similar to the plan the vogue with the White company, served to educate the owner, and that eventually this education would lessen, and perhaps eliminate the demand for free service. There was a specific obligation imposed by the inspection policy.

Co-operation with a customer, rather than doing his work for him, was advocated by A. B. Cumner, manager of the New York City service for the Autocar company, he believing in treating all owners alike and warranting against defects in design as well as construction. There should be no time limit to making good for such defects, for the fault was primarily with the manufacturer, who should be responsible for them. He said that the inspection was largely educational.

Mr. Pulcher suggested that an equitable plan would be for the adjustment of all expense for repairs for which the owner was not responsible equally between the manufacturer and the owner, this being a situation in which both were interested, and he described a plan that is operative in sections where there are no representatives for his company, each purchaser receiving a coupon book good for $200 worth of free service for one year's time with each truck. The coupons are used for the payment of repairs at designated shops, and the coupons are redeemed on presentation to the main office of the Federal Motor Truck Company.

Unlimited free service on defective components was favored by Vernon Munroe, president of the International Motor Company, but he was convinced that payments should not be made for repairs resulting from neglect or abuse or normal wear. The substitution of the word repair for the word service was advocated by J. C. Millman, secretary-treasurer of the Stegeman Motor Truck Company.

Adopts 90-Day Warranty.

The convention then adjourned for the day and at the opening of the second session voted unanimously to adopt the standard 90-day warranty of the National Automobile Chamber of Commerce, and to appoint a committee of five independent makers of trucks to confer with the commercial vehicle committee of the N. A. C. C. to determine and report upon a standard

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service policy to the next convention of truck manufacturers.

The paper, "Can the Dealer Make Money Selling Motor Trucks, and if Not, What Is His Function?" by Robert O. Patten, truck sales manager for the Pierce-Arrow Motor Car Company, Buffalo, N. Y., was then read, and the discussion was begun by F. B. Hutchinson, sales manager for the Kelly-Springfield Motor Truck Company, Springfield, O., which led to different phases, Mr. Pulcher speaking of the discounts that should be allowed agents when trucks are sold in their territory from distant points and of the aspects of the territory and no territory plans of selling. At request Mr. Patten stated that the Pierce-Arrow Motor Car Company did not assign territory to agents, and if a dealer were called upon to furnish parts or deliver a truck in a reasonable radius of his place of business, he is paid five per cent. of the 20 per cent. allowed the dealer making the sale. Mr. Patten was convinced of the value of the standard guarantee of the Pierce-Arrow company, which is given to the purchaser when a truck is delivered. The guarantee is a handsomely printed engraving, which states the precise responsibility of the company, and what it will and will not do. There were no misunderstandings following sales.

The sales policy of the General Motors Truck Company, as stated by Mr. Day, is to restrict the agents to the precise territories assigned to them, not sanctioning sales elsewhere; the company sells machines anywhere, but in the event that the company makes a sale in the territory of an agent an allowance of 10 per cent is made to the agent.

Time Payments.

"Advantages of Selling on Time Payments and How Such Sales Should Be Handled," was the title of the paper by Chairman Windsor T. White, president of the White company, Mr. Pulcher assuming the chairmanship of the convention during the reading. Mr. White considered time payments from the viewpoint of a business man, and stated that such purchasers should be in two classifications—those who for convenience desire to defer payment, and those who from lack of resources must pay in installments. The latter class he regarded as an integrity risk, and while it represented a market of attractive proportions, sales should be made only after credit arrangements insure ample protection. He believed that the payments made on trucks sold for deferred payments should be proportionate to the earnings of the machine if worked sanely.

Vernon Munroe, president of the International Motor Company, was of the opinion that time payments were a necessity in the purchase of motor vehicles, and were not to be rejected, for not only will this method of sale increase, but there is no doubt that abuse of time payment plan is due to faulty business judgment rather than to defect of the idea. Such credit should be restricted to be a safe risk, as well as to the necessities of the purchasers, for otherwise no good would result from sales which the salesmen could force through the accommodation of time payments. He believed that the banks should finance the purchase of trucks, theoretically, at least, and that the buyers themselves should pay for the assistance they obtained from outside sources, paying the commission of underwriting. There was reason to doubt the possibility of standardization of time payments.

Efficiency Governs Earnings.

Sales Manager C. W. Squires, Jr., of the General Vehicle Company, stated that credit terms could not be computed on the basis of the earning capacity of a truck for the reason that productiveness is largely dependent upon the administration, and this is an efficiency that differs with practically every concern. This led to the conclusion that efficient uses should be made of machines that they might earn the payments the owners must make. As the greatest efficiency obtained with the large haulage equipment, and the supposition was that the demand for time payments would be made by those having small resources, an efficiency analysis was absolutely essential before a transaction on an integrity basis should be entered upon. He did not favor the indorsement of the notes of the buyer for discount, or the payment of the commissions of the agents before the payments were made, and he did not believe credit brokers materially helped business.

Mr. Millmann maintained that his observations were that credit brokers were not to be condemned, for he instanced a transaction that was made profitable after a large express company had failed, in which a number of trucks partly paid for were sold so advantageously that gain was realized instead of loss. The rates for the services of such brokers had been materially decreased and were fairly satisfactory. In his own experience he stated that when one of his agents negotiated a time payment sale, five per cent. of the commission went to the credit broker, and that the dealings of the purchaser were either through a bank or a credit house, which obviated any disposition of the purchasers to force free service by delay of or withholding payments. He favored the appointment of a committee to determine a standard time payment policy for the industry to prevent competition that might be destructive because of the terms for which machines would be sold.

Payments on Monthly Basis.

Mr. White proposed that payments be made monthly instead of longer intervals, as being better business policy and safer, and stated that his experience with sewing machines sold on credit had been that the losses did not amount to more than 10 per cent. in 10 years, and the cost of the sale did not exceed one per cent. The clerical work entailed could be handled by a stenographer, and he stated that there was nothing to fear from repossession of property, because this policy proved the business attitude of the seller and established confidence.

Mr. Van Allen did not favor credits extending

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over long periods, but believed that eight months, for instance, was preferable to 12, and held that demands for service should not be permitted to excuse failure to make payments. When requested by Mr. Day, Turner Smith, from the GMC London agency, described the hire purchase plan the vogue with the industrial organizations of England. With this the manufacturer merely produces and the dealer makes all the sales, requiring the payment of 25 per cent. of the price and the remainder in monthly installments, with interest at five per cent., the machines remaining the property of the dealers until fully paid for. Notes were not accepted, because under the English law these represented full payments, and the machine could not be recovered in the event of failure. Cutting prices was not countenanced in England, an offender being penalized by blacklisting.

"Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer" was the title of the paper read by Vernon Munroe, president of the International Motor Company, and this was followed by discussion participated in by William P. Kennedy, traffic engineer of New York City; F. C. Lindoefer, sales manager of the Atterbury Motor Car Company, Buffalo, N. Y., and H. H. Rice, vice president of the Waverley Company, Indianapolis, Ind.

The Need of Motor Truck Shows.

The session was concluded by the reading of the paper, "Is There a Need for Motor Truck Shows or Demonstrations, and What Form Should They Take?" by M. L. Pulcher, vice president of the Federal Motor Truck Company. This paper was discussed generally. One view was that the shows encouraged small assemblers, without resources or much responsibility, to engage in business to the general detriment of the industry, and that shows did not induce business men to motorize their equipment.

Mr. Pulcher's idea was that the truck shows, following passenger car exhibitions, were not at times when business could be well stimulated; that the dealers' expenses were greatly increased and the sales forces were worn out; that decorations were no attraction to purchasers. Separation of the shows would be a benefit and if there was probability of the dangers from small and irresponsible builders, there was exactly the same danger for the manufacturers of pleasure cars.

General Manager Alfred Reeves of the N. A. C. C. favored shows that were not held in connection with or directly following pleasure car exhibitions, and where the expenses were minimized. He believed that demonstrations would attract the business men. Military trials abroad had been of great benefit to the industry. He suggested that for an outdoor exhibition Sheepshead Bay track, New York City, would be an ideal place, and next autumn the propitious time.

Outdoor Show Has Advantages.

Such a proposition was favored by E. O. Sutton, treasurer of the Knox Motors Company, Springfield, Mass., and he believed much benefit would result, but Mr. Millmann was of the opinion that a show in New York City would be too local and advocated developing business by state fair shows and rural displays rather than constant development of the metropolitan sections of the country. E. T. Birdsall, president of the Kosmath company, maintained that annual exhibitions were held by manufacturers of products that were widely known and generally used with satisfactory results, and believed that the same policy could logically be applied to motor vehicles. Mr. Patten while not favoring shows, was favorable to demonstrations, which had been proven practically profitable in his own experience. Mr. White held that this might be due to the demonstration of equipment rather than of chassis. Exhibition at or in connection with trade conventions, rather than at shows or fairs, was advocated by John S. Clark, vice president of the Autocar company. Mr. Pulcher stated that there had never been a real motor truck show and that the value of such exhibitions should not be judged by past experience.

A vote was then taken and the convention decided by an almost unanimous vote not to approve motor trucks shows the present year.

Standards for Load Rating.

The closing session was opened by a paper, "Can a Standard Load Rating Be Devised and Approved by the Manufacturer?" by H. Kerr Thomas, assistant manager of the Pierce-Arrow Motor Car Company, which was read by F. W. Davis, and in the discussion that followed E. T. Birdsall of the Kosmath company directed the attention of the convention to the fact that the results obtained by the formula suggested by Mr. Thomas were very close to those obtained with the formula for the same purpose the vogue with the Society of Automobile Engineers. The convention determined that copies of the paper be sent to the different members, so that the subject could receive the consideration of the engineering departments, and more intelligently acted upon at the next convention. The second paper was "The Future of the Electric Truck," by P. D. Wagoner, president of the General Vehicle Company, Long Island City, N. Y., which was read by C. W. Squires, Jr., sales manager. During the discussion the statement was made by A. C. Downing, sales manager of the Anderson Electric Car Company, Detroit, Mich., that the condition resultant from high prices, that had always militated against the sale of electric machines, would be improved by the construction and sale of vehicles for lower prices, and that the market would be greatly expanded.

Copies of a paper on "The Clayton Act and Powers of the Federal Trade Commission," by Charles Thaddeus Terry, general counsel for the N. A. C. C., were distributed, and the convention was concluded after the reading of a paper by E. S. Foljambe of the Commercial Car Journal on "Limitation of Weight, Size and Speed of Motor Trucks for Preservation of Roads," by the appointment of a committee to co-operate with

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the commercial vehicle committee of the N. A. C. C., consisting of Victor L. Brown, president of the Sternberg Motor Truck Company, Milwaukee, Wis.; E. T. Birdsall, president of the Kosmath Company, Detroit, Mich.; Henry Lansdale, vice president of the Denby Motor Truck Company, Detroit, Mich.; J. C. Millmann, secretary-treasurer of the Stegeman Motor Car Company, Milwaukee, Wis., and H. E. Wilcox, vice president of the H. E. Wilcox Motor Company, Minneapolis, Minn.

TO IMPROVE CONDITIONS, CO-OPERATE---Van Allen.

"What Can Be Done to Improve Conditions in the Motor Truck Business?" was the title under which John W. Van Allen of the Atterbury Motor Car Company delivered the following paper:

I do not assume extraordinary or unusual qualifications in expressing opinions on the manufacture and marketing of motor trucks. I profess only the ordinary business knowledge acquired by experience as an officer in various manufacturing companies, of which a truck company is one, and also as the legal representative of many industrial corporations engaged in various lines. The many diversified problems with which I have had to deal in these capacities have impressed upon me certain convictions relating to the principles, conditions and practise in the manufacture and sale of motor trucks, and you are welcome to them for such benefits as you may receive therefrom. I hope that they will do no one harm.

We are living in a rapid and revolutionary age. Time-honored traditions have been swept away and new practises have taken their places to an extent not fully appreciated, even by those who have been most deeply concerned in them.

We have been in the past a careless, prodigal and unscientific people in our methods of manufacture and marketing our products. However, no one alert to the situation can have failed, in recent years, to notice the many able and instructive articles appearing in magazines and trade journals treating the problems of proper management of business, not only in producing goods, but in advertising and selling them.

While this process of business instruction has been going on, there has also been a very noticeable renewal of activity in discussions among business men, privately and in conventions, assemblies and conferences of those engaged in similar lines and having similar problems to meet.

A few years ago a competitor was an impossible person who must be held at arm's length, while today these conferences have more of the appearance of a gathering of business associates for the discussion of vital problems affecting the industry.

In the month of September, last, invitations were extended for a conference of motor truck manufacturers, dealers and those engaged in kindred lines, and in the month of October, in response to that invitation, some 300 representatives met and discussed matters of interest to the entire industry.

Chief Problems of Truck Makers.

That the men engaged in this industry felt the need of such a conference is evidenced by the number who attended; and the character of the problems needing careful consideration is shown by the questions considered.

Here are some of the topics discussed at that conference:

1. Time payment plans for motor trucks.
2. Territorial lines for dealers.
3. Evils of overloading and over-rating trucks and permissible body weights.
4. Demonstrations—necessity and charges.
5. Reforms needed in merchandising motor trucks.
6. Manufacturer's guarantee and service to owners.

As a result of this conference, an immediate need of an endeavor to co-ordinate in some way the great number of manufacturers engaged in the motor truck industry became apparent to those who had participated in it. The problem then became as to whether this co-ordination and co-operation should take place by joining (1) an existing organization covering both pleasure and commercial vehicles, or (2) an existing organization embracing motor truck manufacturers, dealers, users and the like, or (3) forming a new organization; or (4) holding stated conferences from time to time to which all truck manufacturers should be invited, without a general organization. This problem is not settled.

We must remember that concerns engaged in this business are easily separable into classes, but that there are certain vital principles affecting the whole community of interests.

We boast that the United States is a free country, and that opportunities are alike for all, but I sometimes think that we pay tremendous penalties for this freedom, particularly the freedom with which without adequate capital, without experience, and without credit strength any man or group of men may engage in a business requiring large capital, large experience and credit strength, and do tremendous damage while they exist without gaining any advantage for themselves or their stockholders or the purchasers of their products, and certainly not for their creditors, who are left to mourn over the inadequate remains.

There are serious difficulties to be encountered in connection with each suggestion, but the fact remains, in my opinion, that no plan can be successful except one which permits all engaged in the business to come in and participate, in order that those who most need to be taught the lesson of trade abuses, and who most need the steadying hand of their stronger brothers, may not stumble by the wayside, to the great detriment of the industry as a whole.

I have implied that trade abuses exist—it is a matter of common knowledge to you—and the suggestion has been made that the fatal results which follow the practise of them should be continually emphasized by a process of instruction carried on through the medium of one of the four ways indicated in this paper.

Having thus publicly stated to you these things, it would perhaps be unreasonable and savor of lack of courage or insincerity unless at the same time a frank statement is given of the things which, in our opinion, constitute trade abuses that should be remedied. To the best of my ability, therefore, I will endeavor to outline some of the practises which from a more or less outside standpoint have impressed me as unbusinesslike, inviting disaster and the perilous waste of the resources of the financial interests supporting manufacturers and dealers, without satisfactory results to customers, and so unscientific as to discredit the stability and business judgment of those engaged in it, and lowering the standard of the industry.

Long Time Payments.

There have been certain strong companies doing a national and sometimes an international business, who have, with their wide facilities and tremendous organization, found it advisable, and doubtles profitable, to sell their product in partial payments extending to 16 months, and sometimes more. These companies are credited with a large working capital and with a sufficiently extensive and competent organization to handle the tremendous detail involved in—

First. Passing upon the credit of the purchaser.

Second. Approving, as to substance and legality, the chattel mortgages, conditional sale contracts or leases, applicable in the different states of the union.

Third. Securing adequate fire and liability insurance.

Fourth. Keeping track of dates of maturity, renewals, interest, etc.

Fifth. Time and method and expense incidental to the enforcement of the manufacturer's claim against delinquent debtors.

These matters of detail are expensive and accompanied by many risks and some losses, and compensation therefor must come either from the increased selling price of the product or a lessening of the cost of manufacture by reason of the volume of the business done.

There are a great many concerns engaged either in the complete manufacture or assembling of commercial motor cars, and very few of this number have the necessary working capital, the organization, or the volume to sell their product on a partial payment basis. Some of them, however, either from the habit of imitation, miscalculation, inexperienced judgment, poor judgment, or ignorance, are endeavoring to meet the competition of large companies by giving equal terms in partial payments, with the result in some cases of the gradual extinction of cash capital and of increased debts, largely contingent, but nevertheless a real menace.

In a certain other well known line of business not connected with the automobile industry, this depletion of cash capital by these practises was met a few years ago by the sale of accounts, accompanied by warranty and ruinous discounts, and this condition became so general that in the year 1914 no line of manufacture showed so many failures, and for large amounts. It is significant to us in the truck business, or should be, that the concerns in the line of industry mentioned who failed, and failed ignominiously, were those engaged in selling their product in partial long time payments.

There is room enough in this country for the large and the small manufacturer, each filling his particular field, and all of the methods of the large cannot be followed with safety by the smaller companies. I have no doubt that many of the larger companies, selling by installments, could well profit by the excellent business judgment of the smaller ones in selling for cash, and perhaps in other ways.

If we are to draw any lessons from experience in other vocations, we will find no comfort in the sale of an expensive and movable product by long term payments.

Information Concerning Employees.

One of the decidedly helpful ways in which men engaged in the same line of industry may assist one another and prevent imposition, is by a frank request for information and frank reply as to qualifications, salary and the like, when an application is made for employment by a man looking for a substantial position.

For some reason, perhaps natural on account of its sudden rise, our line of industry seems to have attracted to it many adventurers with no lasting qualities, but exceedingly glib in setting forth the great results obtained in their work for other companies. Our unfortunate experiences in accepting these representations at par undoubtedly have taught us by this time to discount them heavily, but, nevertheless, many manufacturers would undoubtedly save much money and avoid many unpleasant experiences should such an exchange be universally adopted.

There has become prevalent among business men, many of

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whom are prospective purchasers of motor trucks, a decided distaste to a conference with a salesman in which a major part of the time is consumed in condemning the product of a competitor, a practise commonly known as "knocking." Not only does this practise result in harm to the men engaged in it, as well as to their company, but also to all manufacturers of trucks, for things of this nature have a strong tendency to belittle the industry and create the impression that the men engaged in it as a whole are not modern and instead of creating a general sentiment that all makes of trucks have their good qualities, the opposite idea is driven into their minds.

Were this practise of knocking universal, prospective customers would have a right to believe, if they relied upon the words of the salesmen at all, that 99 per cent. of the trucks manufactured in this country were worthless; and should the condemnation extend to the individuals constituting their competitors, 99 per cent. of the men engaged in the business, it might be believed, are nothing less than imposters.

For the sake of the good name of the business, therefore, dignity in merchandising should be continually spread broadcast by those who ought to sustain it on the lines of good business policy as well as of principle.

There are many other things concerning the business of motor truck manufacture and merchandising which are capable of vast improvement.

Many of the younger companies are managed by men not thoroughly conversant with the motor truck business, and who, lacking wide general experience in other lines of industries, fail to appreciate that the margin of profit in this industry is comparatively small, and also fail to appreciate how much of a factor of safety should be provided above actual cost of manufacture, selling and administration to provide for the contingent obligations which many of them assume.

There is a limit beyond which no manufacturer should go in the matter of guarantee, who is selling a product such as trucks, where improper operation could very easily result either in a serious controversy with the customer or the payment by a manufacturer of heavy sums under too broad or too long a guarantee. Experienced men are able to advise us as to the length of time which ordinary conditions would require to develop improper material used in manufacture. What this limit is can best be determined by the technical man in the business. To me it has always seemed that three months would be ample. If a longer time is given, almost invariably it seems that the manufacturer is compelled to make good to save the good will of the customer, whether it is the fault of the product or not.

There is another class of manufacturers who, believing that service is the best kind of advertising—and no one disputes this—have been led into extravagant expenses. Once this practise is established by a company, the small items begin to run into large figures, and this, with other things, reduces the factor of safety and the possibility of profit.

Price Cutting Another Problem.

There is another practise more or less prevalent, and perhaps the most difficult of any to control, and that is selling at less than list prices, either by special discounts, ridiculous allowances for old trucks, or the giving of agents discounts where no bona fide agency exists or is intended to be created. This practise may and does in some cases result in sales, but in nearly all such cases both the customer and the manufacturer are in danger of losing their self-respect, one because of his taking something which does not belong to him and to which he is not entitled, and the other by giving away something that belongs to the stockholders of his company.

I do not mean to say that special circumstances do not exist whereby old-time customers are not entitled to special consideration, where their demands have always been reasonable and where business dealings have been so satisfactory that a reasonable profit would still be left for the manufacturer. I am only endeavoring to emphasize the dangers attending such practises and in no way attempting to pass upon concrete instances, which must be settled according to circumstances.

I am not a technical adviser and cannot even discuss the technical construction of the average motor truck in the market today. I have therefore omitted many details and have not endeavored to give concrete examples of bad practises.

I am convinced that it is the business principles of the industry that need attention at the present time, and that many things might be done to improve them, such as co-operation among manufacturers; elimination of long time payments; long, extravagant guarantees; knocking among salesmen; price cutting; too liberal service policy and the like, and I repeat again what I said in the beginning, that there is immediate need of an organization or of regular conferences where all engaged in truck manufacture are welcome and invited, so that not only good business policies and good practises may prevail, but that the technical men may likewise exchange ideas for the betterment of the product, thus contributing to the general improvement and to the dignity of the business in which we are engaged.

We need to conserve our resources. We need to secure greater confidence by bankers in the motor truck business. We need to educate the general public to the advantages in the use of commercial cars. We need to scrutinize legislation inimical to the user of such cars as well as to the manufacturer. We need combined action to curb high financing in order to obtain and preserve the confidence of those who invest in our stocks and securities, or loan us money or give us credit. We need to inculcate in the minds of every one connected with the industry that the same business principles which prevail in other lines must prevail in this one, if the business is to endure. We need an organization that will teach these things, and promote them, and we need to know each other better that we may acquire a broader knowledge and broader experience in the things which pertain to motor truck manufacturing and merchandising.

QUIT TRADING NEW FOR USED TRUCKS--Day.

The subject of the paper by W. L. Day, general manager of the General Motors Truck Company, was, "How Can the Used Truck Question Be Handled?" and his observations were thus summarized:

You will observe that the subject assigned me is in the nature of a question and that the question asked is not how "should," but "How Can the Used Truck Question Be Handled?" Since I have been connected with the motor truck business I have observed that it can be handled to the entire satisfaction of the man who has used trucks to dispose of by trading him a new one for his old one and that the manufacturer who is more anxious for orders than for net profits, can solve the problem by exchanging new trucks for old ones and a small difference in cash or note. This will increase his sales of new trucks and if he invoices the old trucks at the price allowed for them in the trade, his books will show that he is making money—and they say that figures don't lie.

I make bold to say that it can be handled successfully to the manufacturer only in one way—just as the shoe merchant handles the used shoe question. He has no used shoe question to annoy him and I can see no logical reason why the manufacturer of motor trucks should have a used truck question to perplex him.

If a used truck has any value; if it is still capable of service in its present condition, or is worth repairing for service, it is worth more to the man who owns it as extra equipment for extra work or for use during temporary disability of his regular equipment than any manufacturer can afford to pay for it.

It is not possible to fix the price on a used truck according to the length of time it has ben in service, as is done in other lines, such as typewriters, sewing machines etc.—as there is sometimes more service left in a truck that has been used five years than one of the same make that has been in use less than one year.

Some users of trucks base the life of same on mileage, others on tonnage, while others base it on length of service. A truck, therefore, in the service of some concerns gets more real grief in one year than others would give it in five. The very nature of the use to which motor trucks are put, where so much depends upon the avoidance of overloading, and overspeeding and upon the care of the truck, prohibits the fixing of standard prices for used trucks.

No man living can determine the value of a used truck from a superficial examination. No one, short of an expert, can determine the value of a used truck, and he is as often wrong as right in estimating its value even after a careful and thorough inspecton of its vital parts.

What chance then has the manufacturer whose price on new trucks does not include a trading margin, whose price is based on cost of production plus a legitimate profit, who permits his salesmen—more interested in the sale of a new truck than in the value of the old one—to fix the value of the second-hand truck that he is trading a new one for?

That is what it amounts to, gentlemen—you cannot control it; your salesmen bid against my salesmen for the old truck, always with an eye single to the sale of a new truck, and seldom with any dependable knowledge of either the actual or resale value of the used truck, which is simply another way of cutting the price on the new truck. My observation has been that wherever second-hand truck traffic is permitted there is always a good demand for used trucks among truck salesmen—with the owner as the auctioneer.

Meeting the Used Truck Problem.

When I came into the business I was told that it was common practise among truck manufacturers to take the purchaser's old truck in exchange for a new one—that there was always a good demand for second-hand trucks and that the average sale price of same would show a margin of profit over the amount allowed for them. I confess we were skeptical—that it did not look like good sound business; yet, it did not seem to us best to attempt to set aside what appeared to be standard practise until we had gotten further into the mysteries of the business.

We began at once to keep a record of each trade transaction, in which was shown the amount allowed for the used truck, the cost of putting it in saleable condition, the length of time carried, the cost of sale and the amount received for same, to find that in order to break even on the kind of trading we were doing our prices on new trucks would have to be advanced 21⅛ per cent.

To perpetuate such an unbusinesslike practise seemed to us absurd and impossible, and we decided that regardless of the so-called standard practise, regardless of how anyone else in the industry handled the question, we would quit trading for second-hand trucks, and we did.

That the industry is confronted with a used truck question there can be no doubt, and my remarks on the subject assigned me would be incomplete without attempting to point out a solution for it. To my mind the province of the manufacturer is to produce the best possible truck at lowest possible

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price; to do this all side issues and fictitious values must be eliminated. In my opinion our only recourse then for a solution of the question is the dealer, many of whom are experts in the traffic of second-hand material, which is a business of its own.

My experience in other lines leads me to believe that the dealer operating upon his own resources, paying his own bills and having to look out for his own expense account, is much better qualified to carry on the used truck traffic in a manner to perpetuate the business than is the manufacturer. Speaking for our company we believe that we have solved the used truck question; our way of doing it may occasionally cost us an order, but an order that brings no profit, that leaves a part of our cost tied up in a used truck, is in our judgment a better order to lose than to take.

I might add that our policy in this respect is not patented and if any of our fellow manufacturers desire to adopt it we believe they will find, as we have that it is not only the way the used truck question should be handled, but the way it can be handled.

EXPERIENCE WITH A SERVICE POLICY---Macauley.

Another matter of great concern to makers, "Can Manufacturers Have a Standard Service Policy?" was discussed as follows by Alvan Macauley, vice president and general manager of the Packard Motor Car Company. He spoke as follows:

The term "service" was adopted by motor car companies in the early imperfect days of motor car development, when we were all exceedingly sensitive on the subject of repairs. So we have universally used the word "service" with the thought that it would disguise the existence of our repair departments, and give a beneficient aspect to those necessary evils. I believe that our subterfuge has reacted upon us many times and in many ways. It would have been better, I feel sure, to have handled the situation straight out from the shoulder, calling repair departments by their right name. Then our good patrons would have expected them to take care of repairs. Their functions and activities would have been held within reasonable limits.

My dictionary gives seven different definitions of the word "service," ranging all the way from "spiritual worship and obedience" to "the act of serving: occupation of a servant."

It is but natural that under so loose and indeterminate a name the public should come to expect almost anything in the way of service from motor car manufacturers. And hence the abuses and misunderstandings that have grown up, harmful alike to manufacturers and owners.

The term "service," as it is used in the business in which we are all engaged, covers three branches of work, as I see it:

First—The correction, at the manufacturer's expense, of defects in material or workmanship, for which the manufacturer is properly held accountable.

Second—The repair of vehicles that have deteriorated through use or abuse.

Third—An indefinite something beyond legitimate repair work, which is performed gratis for the purpose of showing the broad gauged, good will of the motor car manufacturer toward the owners of his vehicles.

The good will element of service varies widely with different manufacturers, and even with the different dealers of the same manufacturer. It is supposed to cover a multitude of things that the manufacturer will do gratis for anyone who purchases his vehicles, and which he is under no obligation morally or otherwise to perform, but which he does or agrees to do because it will make his patrons talk of his liberality; in other words, it is good advertising.

I think it is correct to say, therefore, that "service" consists essentially of repair work and advertising.

In the absence of specific promises to his patrons, the manufacturer's obligation extends only to the point of delivering to his patrons cars or trucks of his standard of material or workmanship. There is no obligation upon him to deliver a perfect vehicle, especially since such a vehicle has probably not yet been devised. But there is a strong obligation upon all of us to deliver to our patrons that quality of material and workmanship which we have previously established as our standard of excellence. If a particular vehicle falls below that standard, we must make good without expense, if the flaw develops and is brought to our attention within a reasonable time.

"Advertising" Element in Service.

Beyond this point we are under no moral obligation, and what we may do additional constitutes the advertising element of service. Up to the point where moral obligation ends and service for advertising purposes begins, there should be little difference of opinion among us. But when we enter the good will or advertising element we vary widely in promise and performance. Is there any common ground which it is advisable for all manufacturers to assume and to stand upon, assuming it to be true, as I believe it is, that every one of us is quite willing to go the full length of his moral obligation?

Assuming that we have delivered to an owner a vehicle fully up to our standard, the amount of service he is satisfied with depends in general wholly upon what he has been led to expect. You well know, from experience that your dealer who promises the most to his owners is not necessarily the dealer who has the most satisfied owners. It is not even true that the dealer who actually does the most for his patrons is the one who has the most satisfied owners. The fact seems clearly to be that that dealer has the greatest proportion of pleased users who, at the time of making his sales, explicitly and carefully makes it unmistakeably known to his patrons exactly what they will receive in the way of free service, and just what they will be charged for, and who thereafter promptly and efficiently makes good his promises, even though they are definitely limited in scope.

It is a truism that cannot be denied that in the long run patrons are better satisfied to pay a fair price for service work, if it is done immediately the need develops, and if it is thoroughly well done at the first effort, than with careless, slipshod repair work for which no charge is made.

No other branch of industry with which I am familiar gives, as a general proposition, so much in the way of free service as our own automobile business. The existence of this liberality of free service is undoubtedly due to the fact that as soon as that automobile business was born, scores of manufacturers took it up simultaneously, and from the very outset there was the very keenest competition, which patrons availed themselves of to extract from motor car manufacturers most lavish promises, either expressed or implied, as to what would be done for them without charge. In nearly every other line of business history shows usually some one pioneer who developed it to the point of success, and who established precedents as to repair work and service before he had serious competition, and, under these circumstances, the pioneer manufacturer did not make extravagant promises of free service, and later manufacturers who came into his field usually fell in with the precedents he had established.

Others Promise Little Service.

What kind of service is promised you when you buy a yacht, or a gun, or a locomotive, an installation for your power plant, machine tools, an elevator, or whatnot? In all of these lines we expect the manufacturer to make good if he sells us an article that is below his established standard of excellence. Also, we know perfectly well that if we ask him to do anything more, we shall expect to pay the bill for time and materials, and a reasonable profit. Custom has educated us what to expect, and we accept the result without any feeling but that it is only fair and right to pay the bill. The public generally is willing to pay what it thinks is fair, but what it thinks is fair depends entirely upon its education, and I feel that we have all failed in our duty towards our patrons and our dealers in not educating them as to what is fair and economically possible in the way of service. We have either left them in an indefinite frame of mind, or worse, we have led them to believe that we are willing to give more than we should give, and are able to give.

The public naturally will take all the free service it can get, and whatever is given is accepted as a matter of right. Some dealers in an excess of zeal, arranged to give a day and night service, whereby if a truck were incapacitated during the day's business, it could be repaired over night and ready for use again in the morning. The public was perfectly willing to accept that service without thinking very much about it, and without properly appreciating it. But the dealers found that it was impossible to meet expenses with a 24-hour service, or to secure thoroughly competent repair men who would work in a night shift month in and month out. So the dealers have, in every case so far as I know, been obliged to give up the night service. And then you may be sure a howl went up from the public, who, from having the privilege of night service, came quickly to esteem it an unalienable right. The owners had been educated in the wrong direction. So long as they had never been given night service they arranged their affairs so as to get along without it.

Now there is no denying the value of night service to truck owners. So would a Sunday service be valuable to them, but there are practical limitations that ordinarily prevent a satisfactory service except during the usual time of business.

I cite this merely to illustrate the degree to which satisfactory service depends upon how an owner has been educated. The same principle applies to almost everything we are asked to do for him.

Service Promises Are Unequal.

Some of the troubles connected with service grow out of the difficulty of maintaining uniformity in the various dealers' establishments and among the various manufacturers. The case is found frequently in every city, where a new dealer locates and starts in to create a clientele. In order to quickly secure a following he makes large promises as to the liberality of his service, and for a time at any rate, he does give more than other established dealers can afford to give. He does this, of course, by way of advertising solely, and ultimately he falls back more or less to the level of the other established dealers in his town.

But, in the meanwhile, the pressure is very strong upon the established dealers to meet the attractive service conditions dangled before the public eye by the newcomer. Most dealers fall for it rather than risk losing their customers. So temporarily, in that town, a new standard of service is established, which cannot be permanent because the margins of the business will not allow it. It is economically bad, and the final workout of the situation is disastrous to all the dealers, including the newcomer.

If that newcomer had been educated by experience to the point where he could see the ultimate development of his advertising service, he would not have made the mistake of establishing it upon a plane that he could not permanently maintain. And if the established dealers had been sufficiently educated by experience they would not have allowed them-

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selves to follow the bad example of the newcomer.

Another condition that makes against uniform service is the almost irresistible temptation of the dealer to favor the influential owner. As a matter of right principle, the humblest citizen who owns one of our vehicles should be given exactly the same treatment as James J. Hill, or Henry Ford, or the President of the United States. We try to make it so in my own business.

Education Is the Cure.

It takes education along the broadest lines, repeated and reiterated, to hold dealers level when these not unusual conditions present themselves. It takes valuable time to resist the demands of a shrewd owner, who is bent upon getting something for nothing, or something that wouldn't be given his neighbor. But, in the long run, it pays well to sit down with him and reason him out of his unfair demands, or failing that, to refuse them point blank, because, after all, an owner doesn't appreciate a concession that he extorts, and when he comes back to the dealer a second time he will have the same concession or a better one, or he will take his patronage elsewhere.

Education is what is badly needed—education along broad lines of fair and uniform dealing, untainted by influence or pressure.

Now we have sincerely endeavored to work out our service problems along the right lines I have described. At the beginning of our business existence we were very liberal indeed. I could cite you many instances of free repairs after three or four years' use of the car, but gradually it became borne in upon us that what was given for nothing was not appreciated, and only whetted the appetite for more. The gratuitous element of service work in a large measure lost its advertising value, because many others promised a great deal more than we could possibly perform. The second-hand trading problem loomed large on the horizon, margins narrowed and we realized that it was time to reform our service policy upon a business basis, under which we would fully and completely discharge all of our moral obligations to our patrons, and even go somewhat beyond that for good measure, but also, on the other hand, to definitely limit the gratis work expected of us.

The basis of our new policy was a complete, thorough advance understanding with our owners as to just what we would and would not do. We have not restricted our written service policy over what it was before. As a matter of fact we have enlarged it. The essential difference is that we have cut out indefiniteness by a clear, concise definition of what we will do gratis and what we will charge for. And the new policy we have proven will, if firmly adhered to, hold all our friends, and, at the same time, put our service departments on the right side of the ledger.

We finally arrived at a service policy for cars and a separate one for trucks, because we found that the conditions were so varying that, while the same principles apply to both, the details should be different. Both policies are alike in that they are based upon assisting owners of Packard vehicles to keep their vehicles in best operating condition, rather than assuming the responsibility for so doing. Nine-tenths of that is, and must be, upon the owner and his drivers. And it can be placed there, too, if our dealers have a just, clean-cut service policy and stand by it.

The Packard Service Policy.

As this is a convention of truck manufacturers, I will confine myself to our truck service policy. This consists of two parts—the warranty of the Packard Motor Car Company and, supplementing it, the dealers' service policy.

The Packard warranty is not essentially different from the standard warranty adopted by the National Automobile Chamber of Commerce. It is our dealers' service policy that is new.

Under the dealers' policy, provision is made for giving the owner absolutely first-class service, no matter what happens to his truck. If he provides himself with competent drivers, or if he will arrange to have his vehicles delivered to the dealer's establishment, service should cost him nothing all during the first year, in the absence of accidents. But if, for any reason, he insists upon inspection being made away from the dealer's service department, then he has to pay a very reasonable sum for the luxury.

The underlying idea is that we provide the facilities enabling the owner to get a year's service at no cost, but if he will not bring his vehicles to the dealer's establishment, then he must pay according to the distance the dealer has to send his inspector. The essential particulars of our dealers' service policy can be summarized as follows:

(a) For one year the dealer will inspect monthly the trucks he has sold and make minor adjustments gratis, if the truck is delivered for attention to his service department.

(b) If not delivered to him, and he is obliged to send a workman to wherever the truck may be located, he will inspect and adjust monthly for a year, doing whatever work can be completed within three hours at each visit, for a schedule of charges as follows:

Within a 10-mile radius....................	$1.50
Within a 20-mile radius....................	$2.50
Within a 30-mile radius....................	$3.00

Beyond 30 miles a special arrangement is to be made, based upon the distance the workman has to travel.

(c) The dealer will make all adjustments as often as the owner may desire within the first month after delivery, if the truck is brought to him. After that the dealer charges his standard rates, except for monthly inspection at his service station, and except that during the first 90 days after delivery he will replace, gratis, parts that may be furnished without charge by the Packard company. All gratis work is to be done at the dealer's service station. If a workman has to be sent out to replace the free parts, a charge is made to cover any expenses of the workman.

(d) If the truck is delivered within 100 miles of the dealer's store, an instructor will be supplied gratis for a period of three days, which is believed to be sufficient time in which to break in the driver and teach him to handle the truck properly.

(e) After each inspection the dealer sends to the owner of the truck and to the Packard company a report covering the results of the inspection, which show not only what was done by the inspector, but also the condition in which he found the vehicle, together with any evidences of neglect or abuse.

Our dealers who are making the most satisfactory and successful use of this new policy are, of course, those who enforce it tactfully but firmly. They print it upon the back of their order forms and upon all invoices rendered to their patrons for work done, whether the work be gratis or charged for. In this way, from the very beginning of their relations with the owner, the latter buys the truck knowing exactly what he will and will not have to pay for. He can secure the assistance of the dealer to whatever extent he desires in taking care of his truck, but there is a proper limitation to the work that will be done for him gratis. He is not allowed to impose upon the dealer.

We have not forced this service policy upon our dealers. We worked it out with their assistance, and they adopted it, for the most part enthusiastically, as being an arrangement that offered the owner all possible facilities for having his truck properly taken care of, if he would avail himself of them in the way most economical to the dealer. But if, on the other hand, the owner requires special service, then he has to pay for it a sufficient amount to give the dealer a chance to live.

Can manufacturers adopt a standard service policy? Of course they can, but they won't probably until the absolute necessity is brought home to them through the financial showing of their dealers. It will come in time as a matter of self-preservation. I hope it will come soon, because the margin of profit from the manufacture and sale of gasoline vehicles is narrowing rapidly under the intensive competition.

I believe all of our members are ready to adopt a standard service policy as soon as they are shown one that is in successful operation and which is fair to owners and possible of being carried out by the dealers. Our experience with our new dealer's policy indicates that we have taken a long step in advance. It is showing excellent results and after six months' experience with it, we have not found that we want to change it. I don't mean that we have had no trouble in introducing it. Any change brings complications, but the difficulties have not been serious, and the policy has been successful in every case where the dealer has really tried to establish it.

EDUCATE THE DEALER TO SELL TRUCKS---Patten.

The next paper was delivered by Robert O. Patten, truck sales manager of the Pierce-Arrow Motor Car Company, and was entitled, "Can the Dealer Make Money Selling Trucks, and If Not What Is His Function?" The paper follows:

Among the greatest problems now confronting the manufacturer of motor trucks is the sale of these trucks to the consumer and then properly looking after them so that they will give the satisfaction which may reasonably be expected. Apparently there is great unrest and question as to the best method to accomplish these two objects. Some manufacturers think from-factory-to-consumer is the proper course to pursue, others the branch house, and a third, the dealer: and the equation is being attempted through these three channels.

The author of this paper, having his experience with the dealer method, is of the opinion that this is the most satisfactory channel through which to sell trucks, provided the maker is willing to study the practical problems which confront the dealer, co-operate with the dealer in working out his troubles and, above all, educate him how to sell trucks—and what is equally important, assist the user in working out his troubles.

But ask the average automobile dealer what his experience has been in handling trucks, and the answer in the majority of cases will be one expressing dissatisfaction with the business in all its phases. The main reason for this is the fact that the dealer is usually an automobile man, has felt those qualifications fitted him to sell trucks and has never appreciated the true necessities for success in the truck business.

The automobile dealer, when he accepted a truck agency, did not realize he was entering into a distinctly different field of endeavor. His selling methods of ease of riding, silence, beautiful body lines and casual demonstrations were all upset. He found he was no longer dealing with those who had but a vague idea of motor car construction but, on the other hand, he was confronted with business organizations who in the main were successful, and that he had to convince more than one individual before the sale of a truck was made. Comparing the sale of passenger vehicles and trucks, the latter seemed to be drudgery, and dealers were disappointed over the slow progress they were able to make.

Unfortunately in many instances the sale of trucks from manufacturer to dealer and from dealer to user has been a case of the blind leading the blind. The manufacturer has led

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the dealer to believe many things, and the dealer in turn has, with good intention, passed the misinformation along to the customer, with the result that all these parties, as time goes on, realize that a bad relation has been established. This one point can best be emphasized under the topic of overloading. The maker tells the dealer how strong and rugged is his chassis; how the engineers have provided for safety factors in the vital working parts, and intimates the ability of the truck to carry over its rated capacity. All of this is simply an invitation for the dealer to sell the user a truck with the understanding that it may without injury be considerably overloaded. We all know the outcome of transactions of this kind, which fortunately are becoming less and less, but past instances have caused great damage and loss to the industry. It takes moral courage to turn down a sale, but many times it is the wise course to pursue, and the dealer will all the more appreciate his factory connection if you tell him good reasons why not to make a sale.

Dealers Find Trucks Unprofitable.

Dealers will tell you the truck business is unprofitable because it costs too much for service. If it does, it is largely the dealers' own fault. Motor trucks today are supposed to be sold by the manufacturer on a standard 90-day warranty. If the maker will insist upon the dealer having his warranty contract with the user on this basis, much expense and trouble can be avoided. The dealer, however, seems to feel it incumbent upon himself to extend the guarantee in both terms and time, feeling that otherwise he would lose business. In case of trouble, dealer advises the factory of the point in question being a special one, requests extraordinary consideration, and the factory in turn, rather than quarrel with the dealer, unintentionally becomes a violator of its own contract of warranty. The bars are down and now the line of demarcation between service and imposition is so fine drawn it can hardly be observed.

The condition of affairs can be avoided if the dealer will stand hard and fast to his factory instructions on warranty. When a dealer makes concessions in terms of purchase, he is admitting that the buyer is a better business man than himself, and he is no longer a salesman, but is simply an order taker, who accepts what is handed to him. No dealer today gets any credit from truck buyers for trying to give away his profits and service, and few, if any, orders are actually lost because the buyer cannot have his wishes carried out in every respect.

Unfortunately for the buying public and the dealer too, there has been too little educational matter placed in the hands of the dealer by the factory. The sales manager has demanded sales from the dealers, but he neglects to place in the dealers hands the proper ammunition out of which sales can be created. In place of good, intelligent reading matter as to what a truck may or may not be expected to do, there is too much bombastic talk about efficiency, transportation engineering, fourth fractional figures and other theories. The advertising manager at the factory in his copy invites the public at large to have their transportation looked into free of charge. Like the patent medicine remedy, if the motor truck does not cure all hauling evils, your money back and no charges. This sort of thing has been over done. The dealer knows it is simply bait to create prospects for him, and in the large percentage of cases if he were asked to analyze an important transportation installation he would be scared stiff, and certainly would not or could not afford to do it free of charge. Nor can any dealer be expected to entirely reform, after casual investigation, what it has taken the establishment years to build up. He can only offer his wares for sale, make his recommendation, and allow the buyer to make the choice that their experience dictates will fit the business.

Costs Are Dangerous Ground.

More satisfactory progress in point of sales could be made by dealers if they would concentrate in trying to sell trucks upon the fact that the motor truck is a time and distance saver; point out the adoption of motor trucks by the large industrial concerns and a similar line of selling talk. It is a positive fact that only those who have made a most careful study of costs are qualified to discuss that angle of transportation. The average dealer, if he attempts a discussion of cost figures, will usually either confuse the buyer or, if the buyer is well posted, confuse himself. In the main, I do not recommend a discussion of costs by the dealer. There are too many other attractive points in favor of motor trucks without injecting a rather dangerous and misleading topic, which takes an expert to handle intelligently.

The dealer needs information that he can pass along to his customer. This information if of the right sort is educational and is going to help the industry more than anything else, because the dealer will be telling the truth to the buyer and there won't be any misunderstanding later on. Manufacturers should not be afraid of placing confidence in the dealer, because their interests are mutual, and if the dealer gets into trouble the manufacturer sooner or later will in that territory ride in the same boat.

On account of the author having heard so many misstatements made through pure ignorance, by both branch house salesmen and dealers, he desires to emphasize the plea that manufacturers give their selling connections honestly and frankly essential information, such as how much a chassis weighs; how many miles it runs to the gallon of gasoline and oil; the actual rated horsepower; the speed of the truck and other points vital to the buyer. Unless your selling connections have these facts from you, they won't say they don't know. They will guess, and if they don't guess correctly, then the buyer has to find it out himself and he will feel he has been deceived.

The over-anxiety of the dealer to make sales—an enthusiasm shared by many factory sales managers—has proven his undoing. There is a demand for the motor truck, but this can never be normally increased by price concessions, ridiculous long-term payments, trading obsolete equipment or abuses of that sort. Following methods of sales operation of this kind simply places all of us deeper in the mire.

Great disappointment over the sales made by dealers is a general complaint. A comparison is made with the passenger vehicle business. This is a totally wrong point of view. The sale of motor trucks never has been nor never can be so great as passenger vehicles, for the simple reason there is not the absorbing power. A dealer in a town of say 50,000 population may handle a high priced car, a medium priced and a so-called cheap one. He will within his territory in a good year dispose of probably about 100 cars. He cannot possibly hope to do so well with the motor trucks, because the individual purchasing percentage of passenger vehicles is far and away in excess of the corporation percentage capable of buying motor trucks.

Conservatism Most Necessary.

Utopian fields are not to be reached via the motor truck. Great advances have been made the past five years in the right direction, but there still remains great room for improvement. Conservatism should be the keynote—ultra conservatism on the part of the maker with the dealer in order that all dealings may be on a sound commercial basis. Sales may not be so rapid, but they will be more profitable sales that will bring repeat orders and a host of friends. Dealers who have been unsuccessful with trucks and are discouraged are not themselves entirely to blame. Great responsibility rests with their factory connection, upon whose judgment they have relied and failed. But to the dealer, there are many hopeful signs. Manufacturers in the main have passed beyond the experimental stage so far as cardinal principles of construction are concerned, and the dealer will no longer have to share the heavy burdens of so-called engineering mistakes or be termed a kicker. In addition to this, it can be truthfully said that the motor truck is generally accepted and the great expense of pioneering it as theory is past. Financial accommodations can be had for legitimate transportation expansion by purchase of motor trucks, and purchases of this kind are no longer regarded as an expenditure which is questionable. All of these conditions are cheerful signs to the dealer to try again with the percentage for success in his favor, provided he is conservative in his expectations and method of conducting his business.

In the main the dealers who handle trucks also sell passenger vehicles, and one of the gravest errors made has been the attempt to handle both lines in the same manner. The truck business must be a department in itself. It must have a department manager, salesman and emergency men, who handle trucks and trucks alone. A passenger vehicle salesman, if he is highly competent, cannot also sell trucks at the same time. A truck salesman must know the unit to recommend; the approximate cost of operation; the type of body best suited for the requirements and many other essential points. It is a real man's job to sell motor trucks today, and anyone who hopes to make a success of it cannot straddle the fence and divide his time between trucks and touring cars. At the expense of repetition, dealers departmentize your truck business and your car business; otherwise you will have a failure in both.

The author of this paper believes the function of a dealer may be quite as satisfactory as that of a branch house in handling commercial vehicles. It has been asserted that branch houses can be more directly handled by the factory on account of ownership, and that while a branch house may be instructed to take certain action they may assume only the form of a suggestion to a dealer. The answer to this supposed condition is that any live dealer will listen and accept the judgment of the factory if the suggestion is a good one—and the factory will not make bad suggestions intentionally, whether to branch house or dealer. In case of a dealer or branch house, the effort to attain the same results prevails, and while a factory having a proprietary interest may dictate to any extent, the privilege of enjoying a disciplining power is more than offset by getting from the dealer his greatest effort, which he gives because the profit he makes is his own.

For some unknown reason it is a belief that factory branches carry more complete stock of parts and give better service to customers. Dealers in the larger centres have service stations that compare quite favorably with branch houses, and there is no good business reason why a dealer cannot maintain a business quite as well as a branch house, because in either case it is simply a question of what the business will afford.

INVESTIGATE SERVICE CONDITIONS---Munroe.

The subject on which Vernon Munroe, president of the International Motor Company, spoke, was: "Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer." He said:

A direct and complete answer to this question would be—"Because every manufacturer should know before he sells his product whether or not it will result in credit to himself and satisfaction to the buyer," and in the motor truck business this

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usually requires some investigation.

We may certainly take it for granted that service conditions under which a truck is to be operated should be known to the manufacturer before the sale of the truck is made, if he is to recommend the particular type of truck suitable for the particular use, or if he is to advise the customer not to buy a truck at all, if that is the proper advice to give.

We are somewhat on the defensive in discussing this question, because of the past of the business, its early history and its recent experience, because of our selling methods and our general policy which, unfortunately, have often been subject to criticism by the public and by ourselves.

It is probable that in any new field, in any new industry, it is inevitable that many mistakes in detail should be made, but it would seem as though some of the mistakes made in principle by early truck makers should have been foreseen, as, after all, good business principles are the same in all lines of business, and it should not have taken five nor 10 years to find out that they applied to the truck business as to any other and in like degree.

One principle applicable to all business that all will recognize and will admit, is that the interests of the manufacturer and his customers are, in the long run, the same; that to sell a customer a truck which will not do his work, when perhaps no truck will do his work, is like selling a man a fur coat for use in Cuba or a straw hat for the Arctic circle. Too often has a sale been made to keep a competitor's article out of the market, without regard to the best interests either of the customer or the manufacturer, when it should have been realized that to get a competitor's truck into service when it could not operate successfully is less damaging then to put one's own product into such service.

For the purpose of bringing out more clearly the matter to be discussed, let me reword the question as follows:

"How far should service conditions be investigated before a sale is made to a prospective customer and what should be the nature and extent of the recommendations made?"

Thorough investigation of service conditions should be made to the point that will insure the manufacturer that his truck, when sold, will reflect credit upon him, will result in additional sales to the same or to other customers, and in profit to the particular buyer. It is not conceivable that there can be any marked difference of opinion as to the truth of this statement or as to the wisdom of this policy. Ours is a permanent business and requires for its success a good will that is founded upon as many years of honest, good treatment of customers as is possible. A boiler that will not heat or that will overheat; an egg that will not hatch or that will hatch when not wanted; a truck that will not result in profit to its owner, are alike commodities that will not continue to sell successfully, and none are interested in a dying business. For our own sakes we must determine what is wanted in order to supply it; there must be no guess work about it; it is not a business of hopes and wishes; there is no mystery connected with it and the sooner it is treated as a real business--a machinery business just like any other machinery business—the sooner this industry will be on the right track.

Investigations Always Necessary.

Now, investigations and demonstrations are necessary in the machinery business and will always be so. They are necessary in our business and will always be so—investigations certainly, demonstrations probably—and to the point that investigation is necessary to satisfy the maker that the sale is a right sale, there can be no difference of opinion. Therefore, I think we are justified in saying that investigation and recommendations are unquestionably justified when carried only to the point of satisfying the manufacturer that his product, if sold, will do itself justice and prove satisfactory to the owner.

The question for discussion, on which there may be a difference of opinion, is how far one is justified in investigating for a prospect beyond the point of satisfying ones self as to the sale being a good one, and to what extent recommendations are advisable, especially as to operating after purchase.

This seems to me to be a question solely of selling policy, of commen sense and of good faith.

As a question of selling policy, we must consider the quantity of trucks which may be required by the prospect, the probability that a purchase will be made, the cost of the investigation, the difficulty of determining the truth and the good faith of the prospect.

I do not believe it to be a wise selling policy to investigate, instruct, recommend, without limit, partly because of the heavy expense which such a policy properly carried out would involve, and partly because I feel keenly that it is exceedingly easy for one to get into deep water—over one's head—when it comes to teaching the other fellow something about his own business. If one is fairly to avoid the latter difficulty, it will require the employment of an expert or experts of very unusual calibre who, while having a broad insight into all kinds of business, will also be masters of detail and competent to study and pass upon almost every form of transportation problem likely to exist.

Our salesmen should be of sufficient calibre to know, and to consider in selling, the axiomatic factor determining the wisdom of using motor transport in place of horse equipment—the volume of freight to be handled, the speed required, the road conditions, loading and unloading problems, seasonal conditions, number of working hours, and so on. If the salesman is honest (and we must assume he is, because if he is not we are condemning our own management), if he is reasonably intelligent (which he must be or he will quickly eliminate himself from the business), he should be able to determine with reasonable exactness whether or not a sale is a good one in nine out of 10 cases, and in the 10th he should know enough of the situation to be able to determine which particular factor involved is outside his powers and report to the head of his department for advice and assistance.

Now this 10th case, in a very large proportion of cases, should be fairly clear to the head of the department and should require comparatively little further investigation and not too much study on his part. I say should, because I believe that the vast majority of cases will be covered under my claim that investigation is justified and, in fact, necessary to determine the fact that the sale is a good one from the point of view of the maker. We may, therefore, agree that in determining further the point to which investigation is justified, it is certainly justified as long as it can be done by the salesman and by his immediate superior.

There will, however, always be a large class of cases which will require more knowledge than is possessed by the salesman, more time than the department head has to devote to them, which must be studied by what, in our advertising literature, we are pleased to call our traffic departments.

Traffic Departments Extreme.

Now, in our traffic departments the commodity most important of all is what is required in every branch of our business; namely, common sense—and then more common sense—and then still more common sense. It is a department where, I believe, it is easier to go to extremes than in any other connected with our industry, except publicity. The reason for it is found, I think, in the fact that first the traffic engineer must create a job for himself and unless he is enthusiastic and hard working he will not succeed, and if he is he will likely outrun the safe limits of his duty.

Then, too, the demands upon a traffic department made by the sales department will always be heavy and unless the object of investigations is kept clearly in mind, both by the traffic department and the head of the sales department, the same result will be met as has been met so widely in our service department; namely, a heavy expense built up around service for the sake of assisting in the selling, with results of certain injury to the service and doubtful value to the selling. Now, perhaps, I will appear to have argued in a circle and to have come back almost to the point of saying that investigation is justifiable only from the necessity of assuring ourselves that our product is sold only where it will do well.

Probing Into New Fields.

There is, however, a large class of cases which must be treated on their merits from the viewpoint of developing new fields, and I will attempt briefly to outline a few.

A great railroad company with congested terminals is considering the wisdom of delivering freight by motor trucks instead of by the truck men handling freight for the various consignees. Here is a subject for the deepest and most careful study—a study of traffic conditions, or freight conditions, of railroad practise. Should we be assured of the good faith of the railroad company, of its real desire to know the truth, and its willingness to deal with us; should it be proved that a change to motors will save time, money and friction and conduce to more efficient railroading, there can be no doubt of the propriety of careful investigation at almost any reasonable cost, keeping clearly in mind that the problem is first a railroad problem to be investigated by the railroad with our help and not a truck problem to be studied by us with the help of the railroad. The result may prove the wisdom of changing to motors, in which case the company making the study should secure the sale; or it may prove a change to be unwise, in which case we should be the first to admit it.

Similar cases may be suggested without limit. Probable advantages from the establishment of 'bus lines, or profits to be secured or increased by employing motors for general express service or local deliveries, are fair examples of legitimate prospects where investigation may be extended to great limits, always again keeping in mind that one studying another man's business, as to which he has only a limited experience and insufficient data, must make use of the wider knowledge and experience of the truck man or omnibus man himself.

In this rather hasty and superficial way I have attempted to point out what I believe to be the merits and limits of investigation of the service conditions under which our trucks, if sold, are to be operated.

Let me summarize it again:

Investigation to determine whether or not the truck, when sold, will be reasonably certain to do the work is justified and necessary.

Investigations such as should be made by a salesman under supervision by his department head are also entirely justifiable.

Investigation by a special department for that purpose should be made with great conservatism and then only from the point of view of the customer; in other words, by assisting him to study his own problem and not by studying ourselves—a problem as to which our knowledge of facts must be superficial and our conclusions may be not only biased, but unsound.

In carrying out any policy regarding this important matter, let us always remember we are selling machinery. It is often said we are selling transportation and by that, I take it, is meant that we are agreeing to furnish proper service to customers buying our trucks. We all of us know, I think, that this slogan has led to much misunderstanding on the part of our customers; much misleading by short-sighted salesmen, who think only of their commission, and that it is a heavy tax upon our companies in free repair and guarantee allowances.

We must conduct our business along conservative lines, like any other business, and in accordance with general rules ap-

(Continued on Page 264.)

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"JITNEYS" OPERATED IN 106 CITIES.

ONE of the most comprehensive investigations of national status of the "jitney" 'bus service was recently conducted by the Fidelity Trust Company, Baltimore, Md., for a firm of engineers and contractors of New York City. The investigation covered 138 cities in 45 states and Canada, and shows that of these cities there were 106 in which "jitneys" were in operation. In seven of the 32 cities reported as not having "jitney" services at that time, "jitneys" had been operated, but had been discontinued either through the influence of prohibitive legislation, in one form and another, or through the fact that the operators were convinced that the business was unprofitable.

Of all the cities of the country, Providence, R. I., seems to have the largest number of "jitneys," the total number approximating 900. It was also shown that throughout New England the service had increased more rapidly and to greater proportions than in other sections of the country, not even excepting the West, where the idea is said to have been conceived. One exception to the statement is shown in Boston, where at the present time only one "jitney" line is in operation, two touring cars being run as "jitneys" from Park street to the Fenway baseball grounds. In Maine the B. R. & E. railroad is said to have under consideration a "jitney" service as an extension of its transportation facilities, to operate from Bangor to Winterport. A 12-passenger Stanley steamer is to be placed in service if the plan is matured.

The participation of the railroads, especially the street railways, in "jitney" service is not original with the Maine road. The street railway company of Richmond, Va., recently bought 100 automobiles, which it operates in conjunction with its street cars. The Pennsylvania senate recently passed the "jitney" house bill, which permits street railway companies to enter the "jitney" business. Others will probably follow the example to defend their treasuries from serious inroads. The "jitneys" are said to have forced the Los Angeles, Cal., railway company to reduce its service, while in Oakland, Cal., the earnings of San Francisco-Oakland Terminal Railways is said to have decreased $100,000 in six months. At the other hand, the number of "jitneys" in San Francisco has decreased, there being about 300 less than were in operation three months ago. The earnings of the Atlantic City street railway have been adversely effected to the extent of at least 25 per cent., is a recent statement. The loss suffered by the railway of Hot Springs, Ark., is reported as amounting to about 18 per cent. of its current earnings.

In the larger cities, the "jitneys" seem to find difficulty in gaining a permanent foothold. There is none in operation in New York City, and only a few in Philadelphia, where it is said the public does not consider them seriously. Chicago has but a few. Cleveland and Albany (N. Y.) have one each, while an attempt to institute a service in Buffalo was abandoned when the city council adopted stringent regulations. In the South the "jitney" owners are facing severe municipal regulations, especially in Atlanta, where a recent city ordinance requires each owner to be placed under bond and imposes a tax for the use of the streets. The city council of Charleston, S. C., has anticipated the "jitney," that body having regulations under consideration, although there is yet not a single "jitney" to regulate. In Memphis, Tenn., the number of "jitneys" has dwindled from 369 to 110, with indications that this figure will be even lower very soon. The number in New Orleans is also said to be decreasing. Houston, Tex., has now about 350 "jitneys" in operation. While reports from Winnepeg and Toronto indicate that the "jitney" wave is still at its highest point, the statement is made that in Ottawa one "jitney" was in operation for four days and then was discontinued because of lack of patronage.

International Harvester 'Busses in Use in Omaha, Neb., as Jitneys.

INTERNATIONAL HARVESTER "JITNEYS."

Several manufacturers of light vehicles are producing special bodies on standard chassis for "jitney" service. The International Harvester Company is equipping a chassis with a body that has a side entrance just behind the driver, so that he can conveniently collect fares. As will be noted in the accompanying illustration, a step is provided for passengers, and this is equipped with a hand rail for greater con-

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venience. The storm curtains that fully enclose the body are adequate for the full protection of the passengers in inclement weather. The locality of the scene illustrated is Omaha, Neb.

LONG DISTANCE "JITNEY" LINE.

Probably one of the most ambitious plans for "jitney" service yet devised is that which promoters in Atlanta, Ga., are said to be contemplating. The plan is stated to include the inauguration of a series of overland "jitney" routes that ultimately will provide travel by automobile from New York City through Philadelphia, Baltimore, Washington, Richmond, Atlanta, Chattanooga and New Orleans. Although the name "jitney," which is generally understood to be the equivalent of five cents, will be used, the fare of course will be much greater, probably equal, if not greater, than the fare charged by the railroads serving the same territory.

The plan of operation is to form an association, each member operating his cars over a specific link of the route, the average run of which will be about 25 miles. Operators who fail to maintain the schedule adopted, or to provide suitable cars and accommodations, will lose their franchises. The time consumed on runs will be about equal to that of the average steam train.

Transporting Chalmers' Workmen in Motor Trucks When Street Car Men Went on Strike.

CONDEMNS THE JITNEY.

Wholesale condemnation of the "jitney" has been made by a committee of the Oakland, Cal., Chamber of Commerce after an extensive investigation. The committee's report can be summed up as follows: It has caused a shrinkage of millions of dollars in the value of street railway securities, many of which are held by savings banks, public institutions and worthy investors. It robs the city of a portion of the earnings of the street railway companies, which many of them get under their franchises. It increases the cost of maintaining the streets and roads by wearing out the pavement or surface. As it usually supplies only short haul transportation it is likely, if permanently established, to increase the congestion in the department house districts of cities and limit the upbuilding of the outlying districts. It is likely for the same reasons to increase the property valuations near the centre of cities, while it reduces those in the outlying districts. It increases congestion in streets. Because of the high cost of operation it cannot be permanently successful. If it is successful it will take the form of the motor 'bus rather than the present types of "jitney" vehicles.

CHALMERS' "JITNEY" SERVICE.

In the midst of the spring rush of business in the Detroit plant of the Chalmer Motor Company, the local street car men began a strike and the transportation facilities in their control ended temporarily. To meet the exigencies of the occasion the Chalmers company inaugurated a very complete transportation service, to carry its workmen to the plant from all parts of the city and return them to their homes at a minimum consumption of time. While this service could not be called a "jitney" service, in the strict sense of the word, inasmuch as the company did not demand fares of its workmen, it answered all practicable purposes admirably. The workmen were given badges, entitled them to ride on any of 100 touring cars or the large trucks converted into carryalls, some of which are shown in an accompanying illustration.

The vehicles were operated on definite routes, covering all the main street car lines in the city, and, while the street car men were out on strike, the Chalmers workmen were taken promptly to the factory in the morning and returned to their homes at night as quickly and in a majority of cases more quickly than they could have reached there by the street car systems.

"JITNEY" LEGISLATION.

The Massachusetts legislature has overwhelmingly defeated a bill requiring a bond of $5000 for each car operated in "jitney" service in the state. In Michigan, an ordinance was passed in Grand Rapids providing that the "jitney" owners must pay license fees of $35 to $60, and in addition pay half of the salaries of the traffic squad officers. In Ohio, 15 owners of "jitneys" were forced out of business in Ashtabula when they were required by ordinance to pay a $100 a year license and bond their cars for $5000. In Georgia, the drivers of "jitney" cars in operation in Savannah have secured an injunction to prevent the city from enforcing a "jitney" ordinance which they declare is discriminatory and illegal.

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"JITNEY" LIABILITY INSURANCE.

A limited mutual insurance company to take care of the insurance of members has been organized under the title of the Automobile Liability Association by the Independent "Jitney" Association of Milwaukee, Wis. It will be operated by Wisconsin laws, but cannot do business until applications for 200 policies have been received. This organization is trying to obtain permission for the drivers of cars to smoke, and to allow members of a single family to crowd into a car in any way they are able, and to allow any one under 12 years of age to sit on the lap of another passenger if he or she is agreeable.

CHALMERS TALKS ON SELLING.

A talk to the Chalmers Motor Car Company's dealers from several states at a meeting held at the factory at Detroit, Mich., recently, was given by Hugh Chalmers, president of the company, and although the remarks referred to passenger car sales, they are equally applicable to the selling of trucks.

"Every dealer ought to figure on selling not a monthly quota, but a weekly quota of cars. If you sell two cars on Monday make up your mind that you are going to sell a lot more that week instead of resting on your laurels. If the week opens up well play it to the limit.

"You have just so many cars to sell to make your expenses. Every car you sell after that is velvet. The quicker you sell your first car of the week the more quickly you cross from your expense account to profits. Every hour you take from selling cars you take from the productive end of your business."

The dealers and many prospects they brought with them left the factory in new Chalmers cars. Sixty-eight in all were driven home.

FORD DESIGNS $200 FARM TRACTOR.

While not publicly announced, statement is made in Detroit, Mich., that the Ford Motor Car Company has perfected a farm tractor which it will place in the market next fall which will sell for $200.

This tractor will have the regulation Ford engine, radiator and numerous other parts. One has been built and exhaustively tested on Henry Ford's farm, near Detroit, where it is said to have done the work of six horses over all sorts of ground.

With the prices of horses very high owing to the war—a farmer is now obliged to pay $500 or more for a good team—the possibilities for such a tractor are seemingly very large.

The tests of the tractor so far are said to have been made in all sorts of soil and under all kinds of weather conditions. The tractor will have something of the characteristic Ford appearance. But it will have a much shorter and stronger frame than the touring car.

Above the motor, supported on strong arms, will be two large water tanks, to increase water in the cooling system to insure keeping the motor cool under hard and continuous work. The rear wheels, with steel tires, 12 inches wide, will be equipped with flanges and spikes. The weight of the experimental tractor is said to be 1600 pounds, but the designers hope to decrease this weight to 1500 pounds.

HARRY T. DUNN JOINS OVERLAND FORCES.

Mr. Harry T. Dunn, president of the Fisk Rubber Company, Chicopee Falls, Mass., since its inception, has acquired an interest and has become vice president and director of the Willys-Overland Company of Toledo, O., and in the future will devote the greater part of his time to that company.

Mr. Dunn was largely responsible for the policies that established the Fisk Rubber Company in its present position in the industry. He has long been a close personal friend of Mr. Willys. The rapid growth of the Willys-Overland company and the plans which Mr. Willys has formulated for its future development brought about the arrangement. There will be no changes in the personel of either the Fisk Rubber Company or the Willys-Overland Company.

PITTSBURG BUYS MOTORCYCLES.

The Pittsburg city council has authorized Safety Director Charles S. Hubbard to install in all engine houses motorcycles equipped with fire extinguishers. The motorcycle men will respond to still alarms and emergency calls. They are expected to take care of small fires and to save the department much expense incurred at present by useless runs.

The city recently purchased a large number of motorcycles for the mounted police squad. Horses have been abandoned except for a few traffic men in the down town section. The city regarded the horse squad as more ornamental than useful and the greater speed of the motorcycles is expected to much increase the efficiency of the men.

GOODYEAR EMPLOYEES' SUGGESTIONS.

A system has been adopted by the Goodyear Tire and Rubber Company by which any suggestions that employees may have to make regarding the company's methods may be transmitted to the management and if they are adopted the men receive suitable rewards for making them.

AMERICAN MOTOR TRUCKS FOR GREECE.

The Grecian government has recently purchased 25 KisselKar trucks for army use. These are equipped with standard army bodies and are 1½ and 2½-ton sizes. They are the first American trucks that have been sold to the Greek government.

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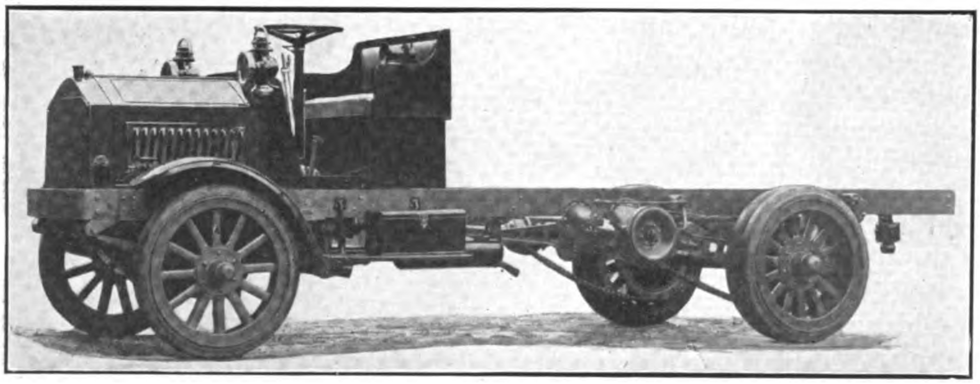
HALL 3½ TON TRUCK.

New Chain Driven Machine Built by Lewis-Hall Iron Works, Detroit.

The Lewis-Hall Iron Works of Detroit has brought out a new 3½-ton chain drive truck. This company is successor to the structural steel business of Henry B. Lewis, who has been in business in Detroit for 20 years. Mr. Lewis is president and Harry S. Hall is vice president. The design was produced by and the manufacture of the new truck is directly in charge of W. K. Ackerman, who organized the old Reliance Truck Company, which was purchased by the General Motors Company and has more lately been connected with the Standard Truck Company.

While the first truck to be put out is a chain driven type, worm driven models are said to be planned, and will shortly be placed on the market. Before the design was completed a careful study was made of the requirements of the British army experts in charge of supplying motor transport and several factors were included to meet their specifications.



Stripped Chassis of the Hall 3½-Ton Truck, Designed to Meet Requirements of Foreign Purchasers.

Among these are the frame construction, the spring mounting for the radiator, a large capacity water circulating system, a 32-gallon fuel tank, tapered point springs and metric spark plug and tire sizes.

The frames are made of six-inch steel channels that have been developed by the engineering department of the new company, but most of the mechanism is the product of well known parts makers. These include Continental motors, Brown-Lipe transmission gearsets, Gemmer steering gears, Kinsler-Bennett and Spicer universal joints and Timken transmission gearset and jackshaft bearings.

The motor has a bore of 4½ inches and stroke of 5½ inches, is a four-cylinder construction and is a unit with a dry plate clutch and the gearset. The gearset is progressive, having three forward speed ratios and reverse. There are four sets of brakes—two on the jackshaft and two on the brakes. The truck is left side driven, with centre control.

The front tread is 65 inches, with five-inch single solid tires and the rear tread with five-inch dual tires is 72 inches. The wheels are 36 inches in diameter and the wheelbase is optional, with 144 inches as the standard. Other dimensions obtainable are 120, 168, 192 and 216 inches. Five-ton springs may be mounted at the rear axle for $10 extra, and for $40 40-inch rear wheels with five-inch dual tires will be mounted. The price of the standard 3½-ton size is $2800.

Owing to special construction of the carburetor the builders expect to get eight to nine miles to the gallon of gasoline. These special features include a Kramer type throttle governor, which operates according to the speed of the mixture as it flows into the mixing chambers of the Zenith carburetor. To obviate difficulties arising from uneven running at low speeds, the carburetor is fitted with a special by-pass so that when idling or running at very low speeds under load the mixture is delivered to the governor valve instead of through the regular mixing chamber.

TRUCKS FOR BOSTON MAILS.

For the purpose of replacing a service formerly performed by the Boston Elevated Railroad Company, the Boston postoffice has arranged for the purchase of 15 trucks. Thirteen of these will be of 1½ tons capacity and two of 1500 pounds.

The larger trucks will be used to transport mails between the various Boston postoffice sub-stations and the main postoffice. The light trucks will be used for parcel post delivery and collection in the down town districts, replacing seven horse wagons now employed for that purpose.

The use of trucks is expected to save much in work which is necessary with the present service. Mail is now loaded into wagons, driven very short distances, reloaded into trolley cars, unloaded and loaded into wagons and unloaded again at the mail terminal.

The trucks will be loaded once and run direct to the destinations. This is expected not only to quicken service, but effect a saving of about $50,000 a year in expenses. Contracts for the trucks will be made by the second assistant postmaster-general in Washington.

"GASOLINE OR OATS."

Under the suggestive title, "Gasoline or Oats," the Chase Motor Truck Company of Syracuse, N. Y., has issued a striking circular comparing the average cost of operating its trucks with the cost of operating the horse teams which they replaced. The circular is based on a specific investigation and report of its traffic department in the case of one manufacturer. The circular presents also in an attractive way the design and specifications of the Chase truck.

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RAYBESTOS A SCIENTIFIC BRAKE LINING.

Increased Facilities at Big Plant of Royal Equipment Company at Bridgeport, Conn., to Meet the Demand for Its Highly Specialized Products.

WITHOUT brakes a motor vehicle is practically impossible of operation; with inefficient brakes it is worthless as a utility and is dangerous, and with good brakes it is the best and most economical means of transportation that has ever been devised. Generally averaged a third of the mileage of a machine is ascending grades, a third descending grades and a third is on surfaces where brakes are unnecessary, so that for two-thirds of the distance traversed retardation of the vehicle must be provided.

No equipment of a power vehicle is subjected to harder usage. No matter what the service, the operating conditions or the capacity of the driver, a great deal depends upon the brakes, because there is no possibility of having certain control unless these are efficient.

Brake construction is distinctly an engineering proposition. A capable engineer can determine very accurately the necessary area of differing materials that will be required to efficiently brake a vehicle moving at a given speed and weighing a stated weight, and he can add to the determined area whatever in his judgment will afford a certain factor of safety. But all engineering computions are based on standards of efficiency of the frictional surfaces, and unless these are known and understood by the operators or owners, and the brakes kept in thoroughly operative condition, the best design and the best material will fail to be efficient.

Where vehicle manufacturers construct the machines they produce in their entirety they build the brakes, but when axles and jackshafts are purchased from specialists the brakes are usually designed to have capacity considerably in excess of the load ratings. There are those who turn to brake specialists to produce for them what will be most satisfactorily efficient and dependable. They have learned that these specialists have scientifically developed brakes and have progressed with their products in the same or at greater ratio than have others engaged in similar works in the industry.

The number of motor vehicles in use in the United States is probably in excess of 2,000,000, and of these about 7½ per cent. are machines used for highway haulage. With this enormous total in service in the highways, with increased vehicular and pedestrian traffic, the demand is for satisfactory safeguards for the public and property, and there is no insurance of safety that can approach thoroughly efficient brakes.

Importance of Good Brakes.

The importance of good brakes is generally understood by engineers, manufacturers, owners and operators, that is, they realize the uses and the needs of them, but they are inclined to accept them as being accurately designed and well constructed, and of such capacity as will be sufficient in any condition. There are instances of vehicle brake design that deserve the criticism of being small when the necessities are known, but the main fault of the engineers responsible for them is that they have assumed the owners and operators would maintain the brakes to the efficiency standard, when as a matter of fact brakes are more often neglected than any other operating component of a machine.

The Plant of the Royal Equipment Company, Railroad Avenue, Bridgeport, Conn., Devoted to the Production of Raybestos Brake Lining and Clutch Facing and Duplex External and Internal Brakes.

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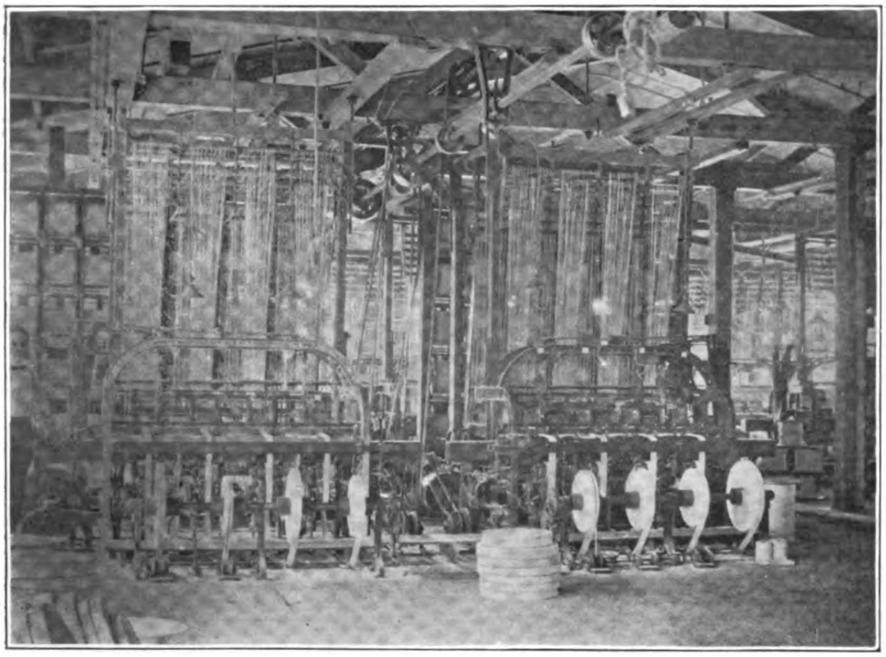


Two Looms Used for the Production of Narrow Sizes, the Yarns Being Carried Practically to the Ceiling of the Room.

The Raymond brakes were built by The Royal Equipment Company, and because experience taught that leather and fabric would not endure, Mr. Raymond conceived the construction of a fabric of asbestos. Asbestos had been woven, but it had not the strength that would endure under braking stresses, and so Mr. Raymond decided to attempt to increase this strength by incorporating brass and copper wire in the yarn for a two-fold purpose, the one to strengthen the asbestos yarn and the other to improve the fabric and make it more enduring when combined with a compound to resist wear and retain a high co-efficient under all conditions of use.

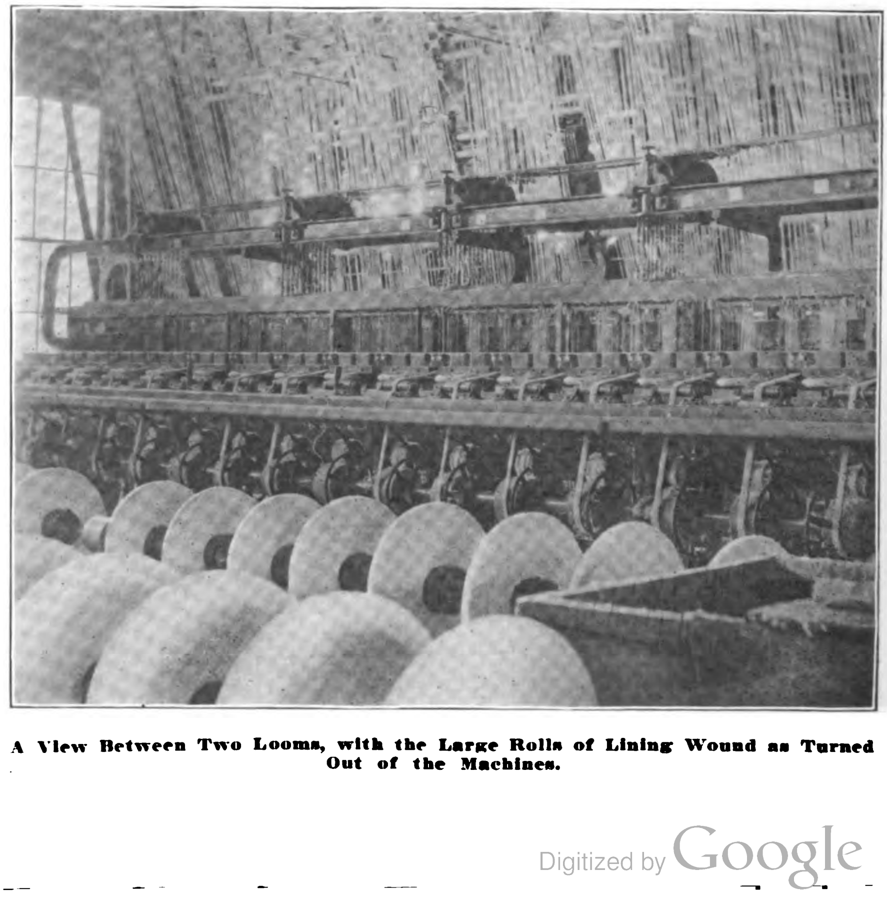
Weaving the Reinforced Yarn.

Procuring asbestos yarn was not difficult, but a special quality was desired and the incorporation of the wire was a process that had to be developed by experiment. After the yarn was obtainable the next essential was weaving it, and this required the construction of special looms. The first loom ever built in America for weaving asbestos narrow fabric was constructed for The Royal Equipment Company, and this was designed to produce a band that would be regarded as very light when compared with brake lining and facing manufactured today, but the machines in use were comparatively small in weight and horsepower.

Asbestos, being a stone fiber, has no elasticity, and the strength of an asbestos yarn is dependent upon the length of the fiber and the tension or firmness of the

Two factors must be regarded as governing the operation of brakes, aside from design, the one being the maintenance and the other the adjustment. Brakes, when the vehicles are new, are ordinarily efficient. The details of maintenance and adjustment are then plainly up to the owners and operators. Brakes are usually of two types, the one being the "wrapping" or external contracting band shoe, and the other the internal expanding type. Brakes are sometimes located on the driving shaft, frequently on the jackshaft, and very generally on the rear wheels. Several machines have been constructed with three sets of brakes, but the third set is regarded as being superfluous.

Brakes are seldom of the metal to metal type because of the fact that higher co-efficients of friction can be obtained with a facing of material that cannot be destroyed from heat and which will not be affected by lubricant, either oil, grease or gasoline, water or abrasives that may be deposited on them during the operation of the truck or car. The first material of this character ever used in America that was practically serviceable was Raybestos, which was invented by Arthur H. Raymond, founder of The Royal Equipment Company, Bridgeport, Conn., who was a manufacturer of vehicle brakes. Prior to that time, 1903, automobile brakes were faced with leather, or cotton, which wore quickly, was hardened and charred by heat, was inefficient if it were saturated with oil, grease or gasoline, and was rapidly cut by abrasives.



A View Between Two Looms, with the Large Rolls of Lining Wound as Turned Out of the Machines.

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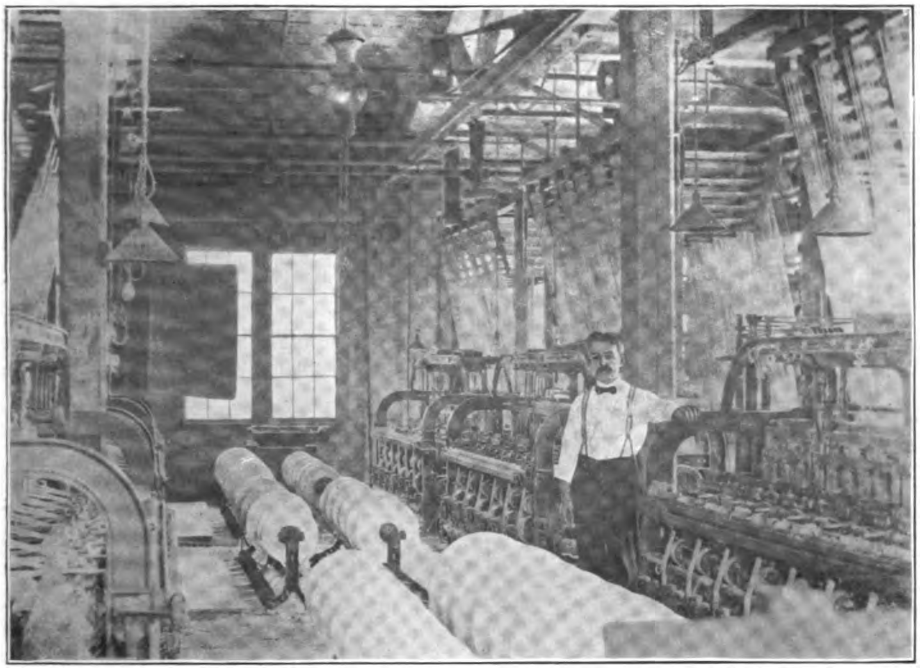

An Alley in the Weave Room Between Six Looms That Produce Different Widths and Thicknesses of Raybestos Fabric.

spinning. The asbestos may be likened, for the purposes of comparison, to a very ductile metal, in that it can be shaped or formed, and it can be changed in shape or form many times without breakage. Attempts were made to use asbestos board, but these had not the strength to resist the stresses and disintegrated rapidly under the pressure of the metal surfaces.

Impregnated and Consolidated.

The wire, which formed the core of the yarn, strengthened it so that it could be woven closely and it successfully withstood the heavy stresses upon it in weaving, and after careful development production of a tape that would resist wear from friction and heat, and which was not affected by lubricants, was practical. But to better serve the requirements the fabric, after weaving, was impregnated with a compound that firmly bound the yarn together, so that it had much greater strength and consequently increased endurance. This was a great improvement, but still greater qualities were desired, and consolidation of the fabric under pressure was undertaken with the result that when finished it was more enduring and could not be permeated by fluids or lubricants.

All of this development was a comparatively slow process, for the material was produced and treatments were varied, and service tests were necessary to determine the qualities resultant from these variations. This material was given the name of Raybestos, and its use primarily was to line the brake bands and shoes constructed by the company. When the brake lining was proven to be of such quality that it could be regarded as a satisfactory and dependable product, the company began marketing it for use with other than its own brakes, because brake lining wears and brakes are valueless unless maintained to the highest degree of efficiency.

Largest Concern in the Industry.

From this beginning the business of The Royal Equipment Company has been developed until today it is the largest concern of the kind in America, and its products are sold throughout the world. It is an industry of constantly increasing proportions, and its growth has been consistent and logical. The plant is in Railroad avenue, in Bridgeport, and it includes six buildings, the largest of which has recently been largely increased, a three-story addition being made that is now being equipped with machinery that will bring the production of Raybestos from approximately 50,000 feet a day to 65,000 feet. This addition is the three-story portion of the main structure, and appears at the left end of the accompanying illustration of the plant.

The company specializes products of highest quality. To illustrate, the asbestos that is used is extra long fiber, and grades that are accepted must be much longer than could be used for any other purpose, for

Part of the Raybestos Weaving Room, Showing the Completed Rolls of Lining and the Asbestos Yarn Spools in the Foreground.

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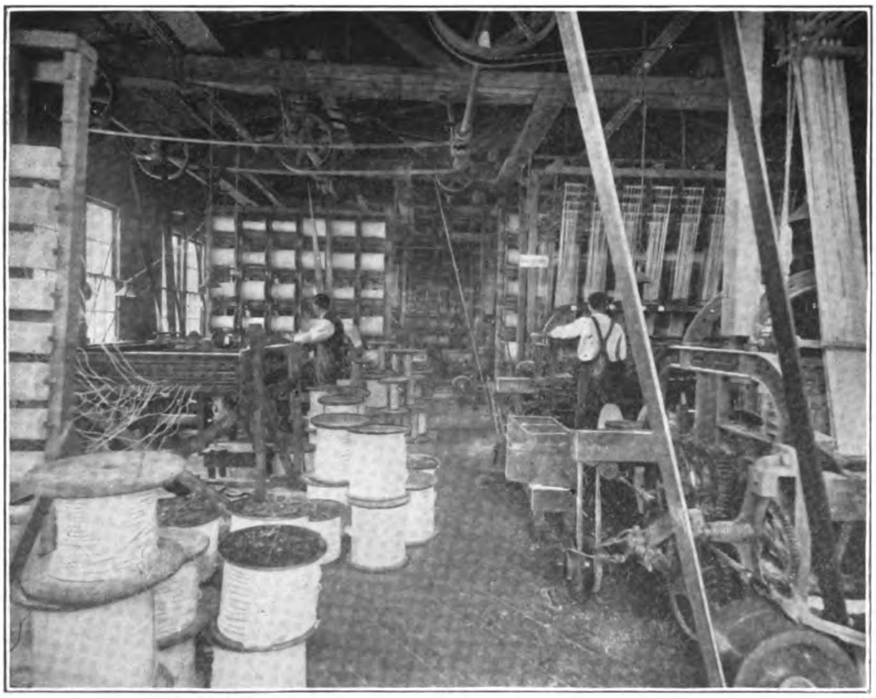


Another Section of the Weave Room, the Asbestos Yarn Being Wound on Spools at the Left, with the Looms Beyond.

the strength of the yarn is dependent to a considerable degree upon its length. This material is specially selected and a high price is paid for it. The asbestos yarn is then spun, the different uses requiring one or two strands of brass or copper wire and two, three or more asbestos threads, the wire forming a core about which the thread is twisted to varying degrees of firmness. For some purposes brass wire is best adapted, and for others copper. Of course the yarn varies in size.

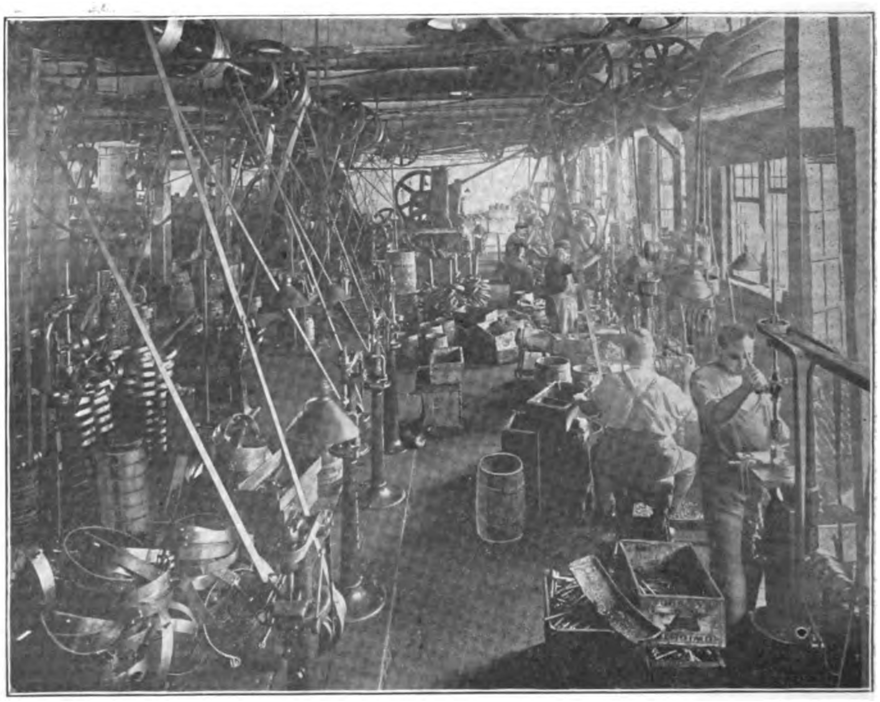
When received at the plant this yarn is wound on paper tubes, from which it is rewound on to spools or bobbins, that on the spools being used for warps or longitudinal threads, and that on the bobbins for the filling or transverse threads. The winding is done by special machinery. After the winding the yarn is ready for weaving. The looms used are built to the designs of the company and vary in size, although they do not differ much in general principle of operation.

The lining is made in 33 standard widths and nine thicknesses, or 264 different sizes. The fabric is woven a minimum width of one inch, and it is increased by eighths to and including four inches, and then increased by quarters to six inches. The minimum thickness is eighth inch, and it is increased by 1/32 inch to a maximum of 3/8 inch for all widths up to and including six inches, and for all standard widths in excess of four inches. But fabrics are regularly made to special order to 18 inches width and 5/8 inch thickness.

Obviously the looms must be such that with them any size desirable can be produced in sufficient quantity to meet any requirement, and the weaving is done to meet the demand for stock and for special order. The looms of the smallest size produce four rolls of lining at an operation, and the number of rolls is increased by multiple of two. The looms are adaptable, so that more than one thickness and several widths can be produced. They are massive machines, reaching from the floor to the ceiling, the largest working yarn that is very heavy. Production varies, but generally about the same feetage is turned out by each loom in a given period of time.

The wire used in the yarn is fine, and strength is obtained by increasing the number of strands, so that when the lining is woven it is surprisingly flexible, and yet it is extremely closely drawn and is firm and hard. The rolls will average about 150 feet each of lining, and after weaving these rolls are sent to the stock room for storage until ready for treating.

The looms are complicated machinery and can only be operated by men who have been carefully trained. They are adjustable for the production of different sizes within certain limitations. As the business has increased the weaving room has been enlarged, new machines being built, and frequently considerable time has been taken to obtain efficient and satisfactory operation of the looms after they were installed.



Machine Tool Department That Is Given Over to the Production of the Parts and Fittings of Duplex Brakes.

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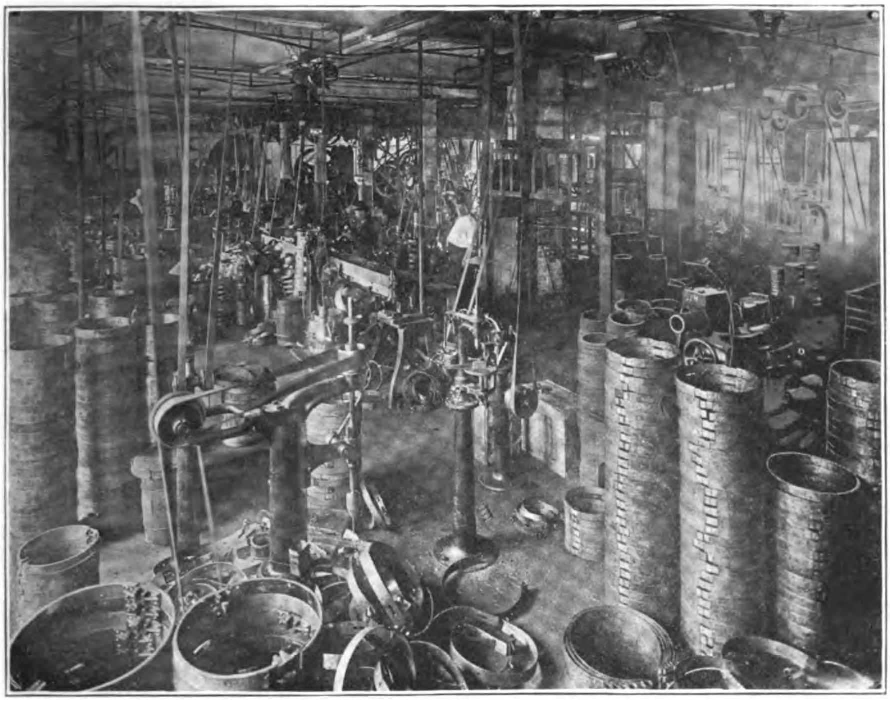


One Division of the Brake Department, Where the Steel Bands Are Machined and Fitted with the Standardized Parts.

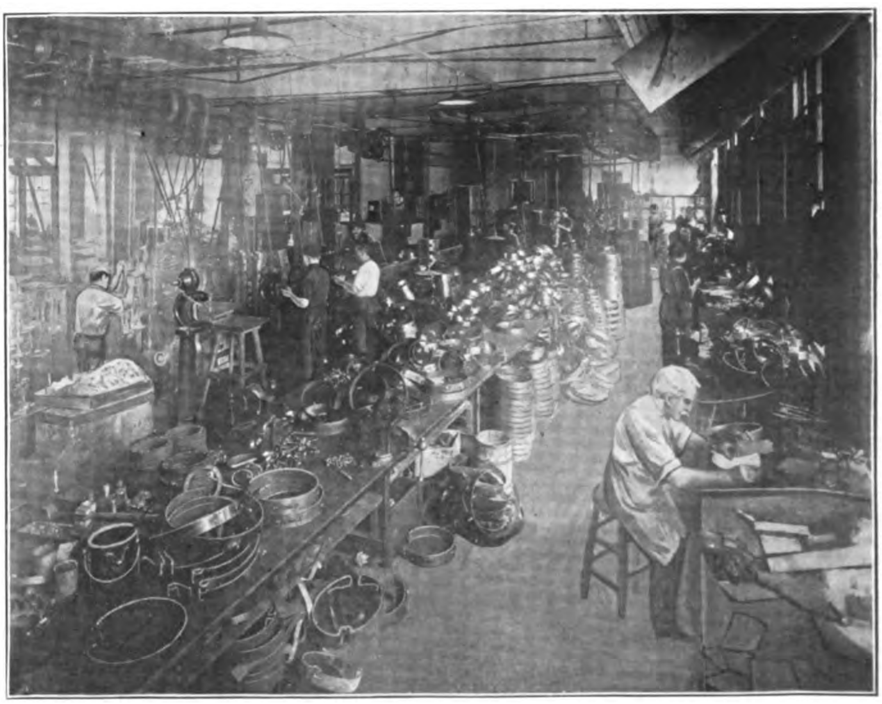
The treating department is not open to visitors and the formulae of the treating compounds are unknown to others than the chemists who have charge of their preparation. These compounds are so applied that they impregnate and bind every part of the fabric and during the treating process the material is subjected to heavy pressure that so consolidates it that it cannot be compressed when in use, no matter what the compounded leverage of the brakes on which it is used. This consolidation is the same through the lining. The purpose of the treatment is first to bind the yarn, second to give it frictional qualities, and the third to insure endurance in any operating condition.

In the manufacture of Raybestos extremely careful tests are made of the different yarns to insure uniform strength and weight and closeness of weaving, and the quality of the asbestos itself is very closely examined. Different machines are used in these tests, and there is another series of machines in which braking efficiency is determined, and still another in which endurance is learned. By testing the material and then the fabric, both before and after treatment, and wearing it completely through, extremely accurate data is obtained, and with this and by comparisons with standards, the quality of the lining is uniformly maintained. Experiments are constantly made to still further perfect the material, because of the expectation to improve the qualities that are now obtained.

"Quality First" is a sign that is displayed conspicuously in every department of the plant, to emphasize to the workmen that all other manufacturing considerations are secondary, and that any condition that would militate against obtaining this quality will not be countenanced. It is noted by visitors, of course, but visitors are very few as compared with the users of Raybestos, who have no knowledge of the actual production conditions. The company is certain of its products and it guarantees to all purchasers of Raybestos who use it for brake lining on pleasure cars and motor trucks to 3000 pounds capacity, a satisfactory service for a year without regard to mileage or condition of operation, and that it will replace without cost all Raybestos brake lining that does not endure during such periods. The production of the company is approximately 50,000 linear feet annually, and during the period that the guarantee has been effective, even including demands made by a number who believed they had Raybestos, but did not, and those whose material could not be identified as Raybestos, the company has replaced so small a feetage that the proportion is negligible, it being less than a foot to every 15,000 feet produced.

Large Production of Clutch Facing.

The company manufactures Raybestos discs for clutch facing in rings of varying diameter, width and thickness, and this is subjected to a somewhat different treatment than is the brake lining, and while



In the Brake Manufacturing Department, Showing the Machining Processes and the Assembling of the Equipment.

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the weaving process is the same the rings are formed and cut and the ends are joined and fastened with special metal clips, the metal varying with the assembly in which they are to be used. These rings are pressed to take the heads of the rivets, and sometimes they are drilled, the depressions serving the purpose of countersinking, though frequently they are made without drilling, the fitting being done by the clutch manufacturer. The reason for the different treatment is that often these clutch rings are operated in lubricant and a different degree of friction is necessary.

The uses for frictional material are constantly increasing and the company is meeting these demands, very often by special production, for Raybestos has been found to have every quality sought by engineers.

Brake Department Very Large.

The brake department is large and is splendidly equipped. This is located in the ground floor of the main building and it is given over to the production of the parts and fittings of both external and internal Duplex brakes. The company does not operate a foundry and the steel stock for the external and the internal shoes and the castings for the fittings are supplied by contract. All the other metal parts are produced, and one section of the department is equipped with machine tools for making and machining them, steel stampings being largely used. The department also has a number of small automatic machine tools for production of small parts. The tool room is exceptionally large and contains an admirable selection of machines, including lathes, grinders, drill presses, arbor presses, milling machines and similar equipment, as well as heating furnaces and a forge. Here all tools used by the plant are made, and in a vault are kept the master patterns as a protection against fire.

The Duplex brakes are built in several types, internal expanding and external contracting, the latter in light, heavy and extra heavy designs, which are differentiated as models B1 and B2, B11 and B12 and B21 and B22 respectively, and the former as model C1, while models 50, 51, 52 and 53, which are internal expanding, are specified as special brakes, in which classification is also included external brakes that are known as models 54, A1, 55 and 56 and a cycle car brake. All of these brakes are designed to afford the most efficient service and long experience has developed constructions that will exactly conform to the internal or external diameter of a brake drum, so that there will be the full braking area of a band or shoe in contact with a drum when the brake is set.

Brakes Have High Efficiency.

The braking leverage is compounded, so that a comparatively light pressure upon the pedal or lever will exert the full effect, and the adjustments are such that there is full clearance when the brake is released, so that there is no retarding influence upon the wheel drums, causing stresses and consumption of power, when the vehicle is in motion. The brakes are very carefully built to standards that have been proven to have the greatest efficiency, and as a brake specialist the company maintains that its product is unequalled, for what has been developed has been produced by extremely careful engineering, scientific methods and experience extending over the entire period of the time the company has been manufacturing.

In other words, only by the production of brakes of undoubted superiority to other construction could the business be expected to be substantial and enduring, and the best evidence of the qualities of the brakes are their use by many manufacturers of high-grade machines, both pleasure cars and service vehicles. In addition to the Duplex brakes the company produces the Raymond brakes, these being of special design adapted to certain classes of machines.

Are Made in Many Sizes.

Models B1 and B2 Duplex external brakes are made in six to 12 inches diameter for widths to 1½ inches, from six to 14 inches diameter 1¾ inches width, from six to 16 inches diameter two inches width, and from six to 18 inches diameter in 2½, three and four-inch widths. Models B11 and B12 are made from 10 to 16 inches diameter in two-inch width, from 10 to 18 inches diameter in 2½ inches width, and from 10 to 20 inches diameter in three and four-inch widths. Duplex model C1 brakes are built from 10 to 20 inches diameter and in 1½, 1¾, two, 2½, three and four-inch widths. Raymond brakes, known as models A4 and A2, are built from six to 12 inches diameter up to 1½ inches widths, from six to 14 inches diameter in 1¾ inches width, from six to 16 inches diameter in two inches width, from six to 18 inches diameter in 2½ inches width, and from six to 20 inches diameter in three and four-inch widths.

The company manufactures pressed steel brake drums 2½ inches width and in four diameters—8¼, 10, 12⅜ and 15 inches, and in 4½-inch widths 14, 16 and 18 inches diameter. Other specialties produced are a Duplex external emergency brake equipment and internal cam brakes for Ford cars, special Ford chatterless transmission brake lining that is cut and made ready for application, and special leather fan belts for Ford cars.

Besides Raybestos brake lining a special quality facing that is given the trade name of Stability friction brake facing is produced in widths from one to 2½ inches by quarter inches, and three and four-inch widths, and in 5/32 and quarter-inch thicknesses. This material is cheaper than Raybestos and is sold for a medium price, the claim being made for it that it is an extremely good quality, and that it meets the requirements of those who want a very serviceable lining at comparatively small cost.

The company has been operated overtime since the first of the year, the average being 13 hours daily, to meet the demand upon it, and the additional looms, which will shortly be in readiness for operation, will hardly suffice to operate normally on a 10-hour basis if the conditions of the market continue. With the new addition 65,000 square feet of manufacturing floor space is used, or approximately an acre and a half.

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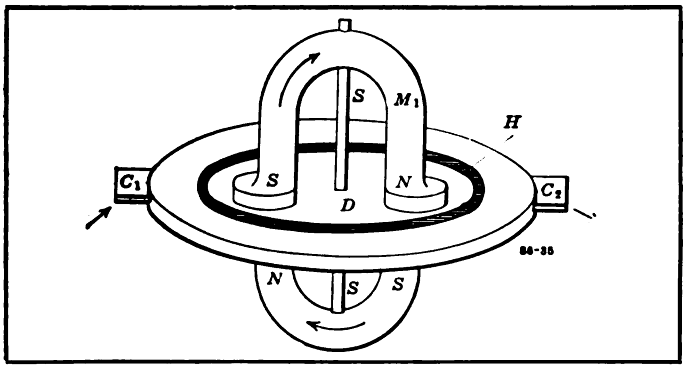
ELECTRIC VEHICLE PRACTISE.

Means of Indicating the Current Charged Into a Battery and the Power Available for Useful Work—Principles of the Mercury Motor Used in the Sangamo Ampere-hour Meter and the Means for Obtaining Varying Control.

By William W. Scott.

FROM previous statements the reader understands that the voltmeter and the ammeter have specific uses in the operation of batteries. The voltmeter will indicate the voltage or pressure in any circuit at any given time, and by taking the readings very closely together an experienced man might satisfactorily meet the requirements of accurate work, for the voltmeter will record either the charging or the discharging current. The ammeter will indicate the amperage or quantity of current being supplied to or drawn from a battery, and readings can be taken as frequently as may be necessary.

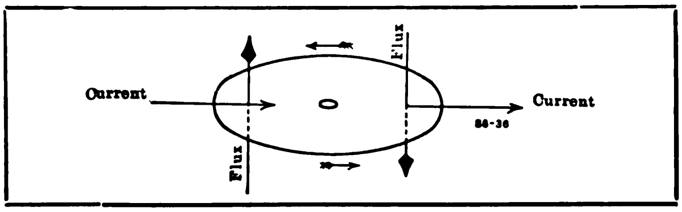
But the obviously even with the best of judgment and long experience continued readings are absolutely necessary. The voltage must necessarily increase with charging and decrease with discharging, and the current is supplied at the initial and finishing rates



Electric and Magnetic Circuits of the Mercury Motor of the Sangamo Ampere-Hour Meter.

when charging, but when discharging the quantity of current consumed is decidedly varied. Battery cells are designed for charging and discharging at specific rates, and the greatest capacity is obtained when these rates are adhered to. Cell capacity will vary slightly with the type of plates used, but generally it will diminish from five to eight per cent. when discharged in six hours, from 12 to 20 per cent. when discharged in four hours, from 30 to 40 per cent. when discharged in two hours, and from 45 to 55 per cent. when discharged in one hour. The figures are based on normal operating and with conditions which justify the output at the eight-hour rate being regarded as 100 per cent.

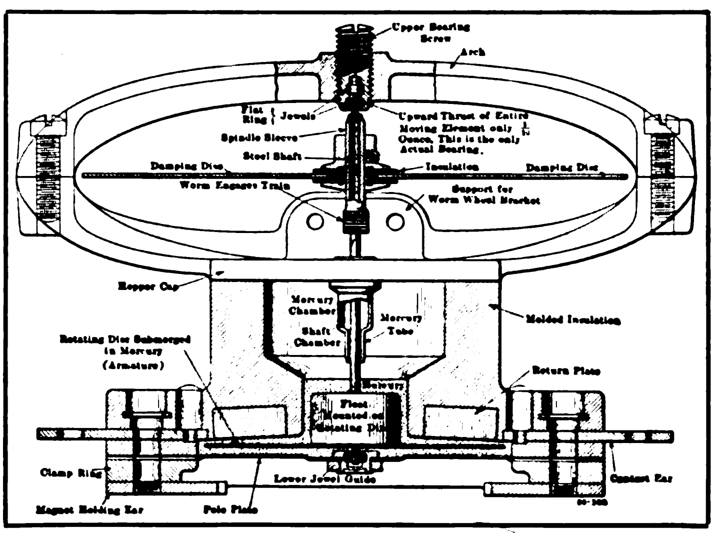
The voltmeter will indicate the rise of the voltage when charging, and the fall of the voltage when discharging, but unless discharge is begun directly following charging there will be a voltage fall of considerable rapidity, after which the voltage will remain at an approximate standard until toward the end of the discharge, when it will again rapidly fall. Obvious



Relative Directions of Current, Magnetic Flux and Motion of the Copper Disc of Sangamo Ampere-Hour Meters.

this characteristic will prevent very accurate knowledge of the quantity of current that is available for power in a battery, for the indication is not of uniform diminution. The experienced electrician may be able to judge very closely the condition of a battery as regards available current, but he will not make even an approximate estimate unless he has knowledge of all conditions that might cause variation of the current.

The ammeter will indicate the current that is supplied to the battery when charging and to the motor of the vehicle when it is being operated, but the instrument will not measure the loss through internal discharge, and for this reason it cannot be depended upon to afford the accurate information that might be desirable, that is, it will not show the true condition of the power available in the battery when it is in service. The ammeter will measure the current that passes through the instrument, but it will not indicate



Cross Section of Mercury Motor of Sangamo Ampere-Hour Meter, with Recording Mechanism, Field Magnets and Damping Magnets Removed.

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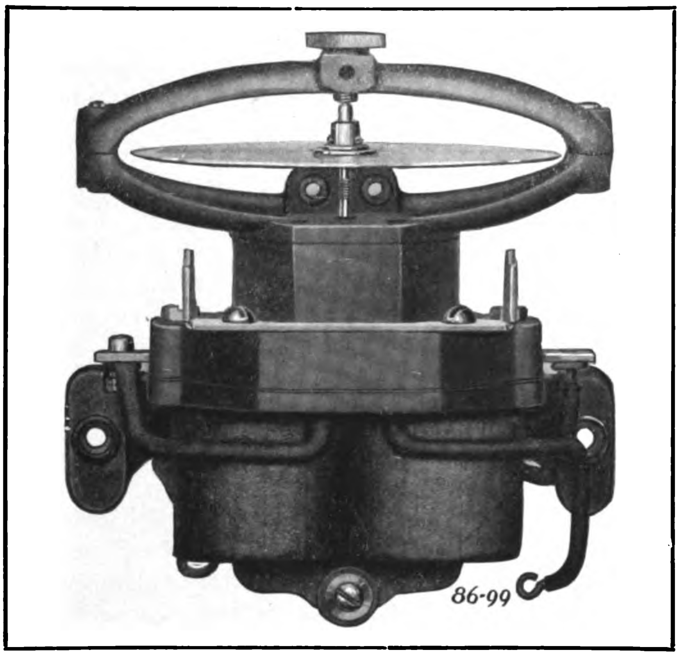
the power that is available in the battery.

Considering a battery from the viewpoint of standard efficiency one may assume that its rated capacity is available. This is true of a battery up to the point that its capacity has diminished, and when the manufacturer rates the battery capacity of a vehicle, that is, the probable mileage that can be obtained on a battery charge, he does so by averaging the current consumption a mile. That is, if the capacity of a battery is 300 ampere-hours with the voltage fall from the full charge to the minimum of 1.75 volts a cell, and the average demand with load half the distance driven is five amperes a mile, he is justified in making a vehicle rating of 50-55 miles and still have some reserve in the event the maximum distance were driven.

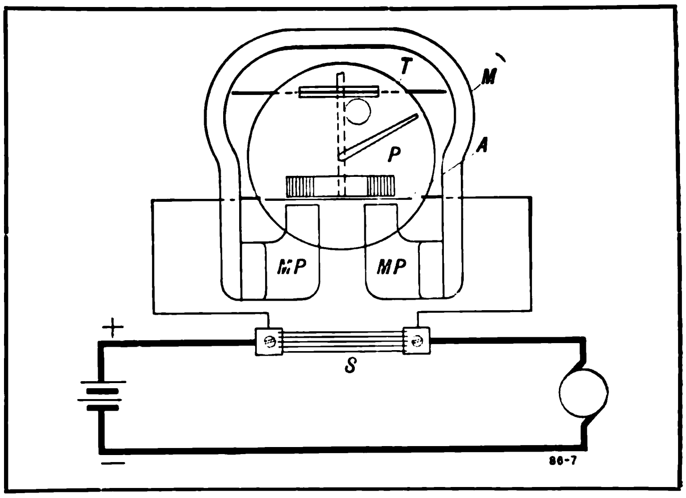
The custom with battery manufacturers is to estimate the battery in ampere hours. Theoretically the battery ought to supply a specific number of amperes for an eight-hour discharging period, a greater num-



Front View of Motor Element of Sangamo Two-Wire Direct-Current Watt-Hour Meter with Recording Mechanism and Light Load Adjustment Removed.

ber proportionately if the period is lengthened, and a smaller number porportionately if the period is shortened. To reduce this ampere-hours capacity to mileage the vehicle builder rates the battery by its normal output and divides this by the number of ampere-hours necessary to drive it a mile. The statement may well be made here that when a battery is quickly discharged all of the current it has available is not discharged, and if left for a period it will recuperate, that is, it will later on supply some of the power not drawn from it by the rapid discharge. If the battery were placed upon charge because of the residual power or current remaining, the battery would not require as much current to fully charge it as when it were completely discharged.

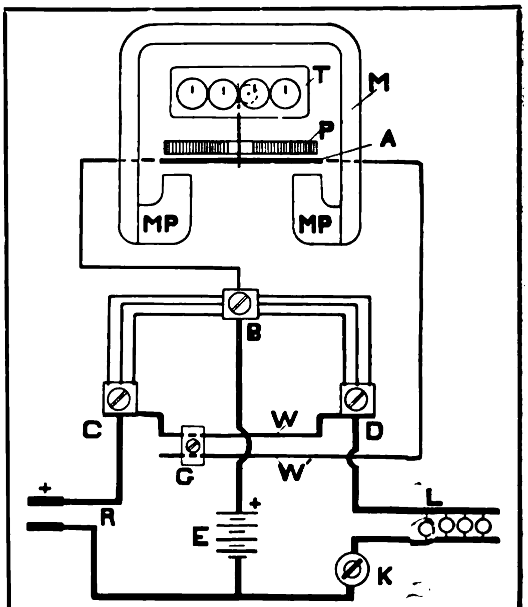
These facts are reiterated because of their special bearing on the use of the ampere-hour meter, an instrument that is especially serviceable and which is very generally used as vehicle equipment because it will indicate the mileage capacity of the battery very accurately, but this cannot measure the current that is



Circuit Diagram of the Simple Shunt Sangamo Ampere-Hour Meter.

lost by internal discharge or that is not supplied to the motor. Emphasis should be made of the variables with which the electrician must deal, and which cannot be made known by measurements or indications. Obviously specific gravity is the most reliable determination of battery voltage, but these readings are not practically obtainable when the vehicle is in use, and the ammeter cannot show the available current.

The ampere-hour meter can be used in charging or discharging, for it will indicate the current that has been supplied to the battery through it, and the current that has been drawn from it for power or other purposes. If the battery had been fully charged and had not been used or drawn upon for several days the ampere-hour meter indication would be more than the battery would deliver, and if the period of idleness was of considerable length an additional charge, which should be based on the specific gravity of the electrolyte, would be the prudent, for the condition of the battery with reference to current would not be sufficiently dependable to justify operation, and in such a circumstance a slow, freshening charge would be necessary to restore efficiency.



Circuit Diagram of the Differential Shunt Type Sangamo Ampere-Hour Meter.

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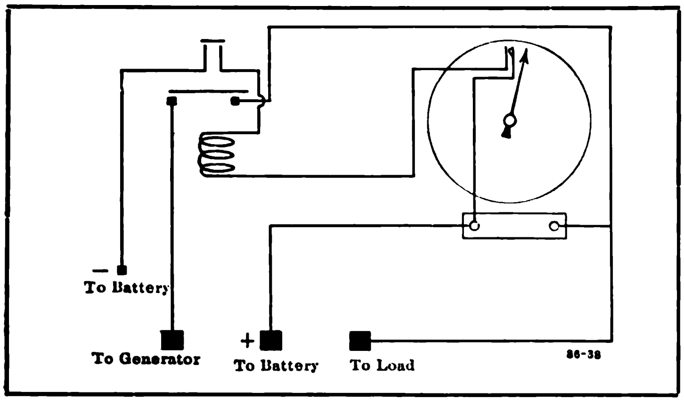
In connection with ampere-hour meters the suggestion is made by manufacturers that the capacity should be from 25 to 30 per cent. greater than the nor-



Circuit Diagram of the Charge-Stopping Device of the Sangamo Ampere-Hour Meter.

mal discharge rate of the battery with which they are used, and the ampere-hour dial value should be not less than 25 per cent. greater than the rated capacity of the lead battery and not less than 50 per cent. greater than the rated capacity of the Edison battery. This provision is made so that there shall be sufficient capacity to meet any condition of overcharge and insure certain accuracy.

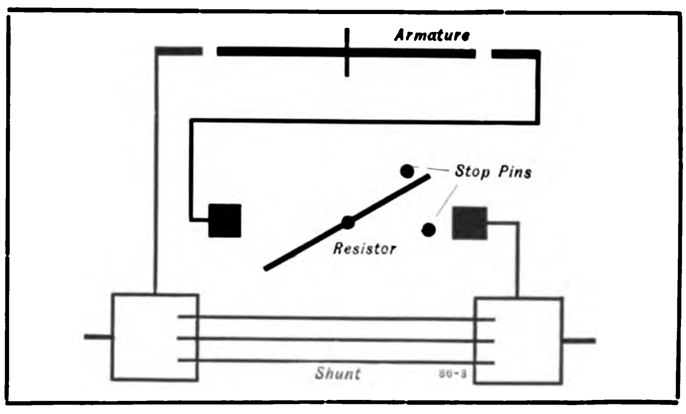
The ampere-hour meter most generally used by vehicle manufacturers is the Sangamo or mercury flotation type of instrument, which is claimed to be the only one that will endure the severe conditions of vibration and shock resultant from general service. The meter is essentially a small motor in which a copper disc is the armature and this is floated in a volume of mercury between the poles of a magnet, being provided with leads to and from the mercury at diametrically opposite points. This form of meter is known as the Faraday type, and the principle is the action of the magnet upon the copper disc, which is free to rotate while carrying current.

The theory of the operation of such a meter is shown in an accompanying illustration of the electric and magnetic circuits of the mercury motor. The current of electricity enters the motor at the contact C1, passes through the comparatively high-resistance mercury H to the edge of the low-resistance copper disc D, across through the disc to the mercury H and out at the contact C2. The magnetic flux cuts across the disc on each side from N to S, making a complete circuit through M1 and M2, the relative directions of the magnetic flux and the current of electricity, as well as the resulting motion, being indicated in another illustration.

From this one will note that normally the disc supported by the mercury has a movement that is counter-clockwise, or from right to left, that the current crosses the disc from left to right, while the direction of the magnetic flux is clockwise. The relations of the current and the magnetic flux, and the direction of the movement of the disc are shown in the diagram. According to the laws of electro-magnetic induction, if a current-carrying conductor cuts a magnetic field of flux at right angles, a force is exerted upon the conductor, tending to push it at right angles to both the current and the flux.

When connected to an eddy-current damper or generator which requires a driving power directly proportional to the speed of rotation, the mercury motor becomes a meter. The speed of such a meter is a measure of the current or rate of flow of the electricity through the motor element, and each revolution of the motor corresponds to a given quantity of current. In other words, when such a motor is used it is connected with the circuit by a shunt, and a definite ratio of the current, passing through this shunt, indicates on a calibrated scale the quantity of current that has passed through the circuit. And if there is knowledge of the quantity of current charged in the battery the indication will be that of the energy still available. That is, if 250 ampere-hours were charged into the battery, and an average of four ampere-hours were required to drive the machine a mile, the available mileage could be regarded as approximately 60, assuming the battery and vehicle were operating to the standard of efficiency, so that a trip of 50 miles could be undertaken with assurance that there would be sufficient current for this and a reasonable excess for unforeseen requirements. At any time the difference between the current charged and the current consumed, divided by four, would afford a reasonable approximation of the current unconsumed, expressed in miles. The mechanical indication is obtained by connecting a revolution counter to the motor generator, a specific number of revolutions indicating an ampere-hour.

In practise the ampere-hour meter is primarily a non-conducting material that is moulded to contain a chamber, which is shown by the accompanying diagram, and in this is imbedded the upper part of the motor magnetic circuit, which is a laminated soft iron ring, which is indicated by the vertically-lined section of the base of the material forming the chamber. At either side of the base is shown the contact ears, and below these is the pole plate. Under this is the clamping ring and the magnet holding ears. This chamber is closed by the pole plate at the bottom and the hopper cap at the top, and the space between the pole plate and the base of the insulation block, and in the centre of the chamber, to the height of the lower ver-



Circuit Diagram of the Variable Resistor Type Sangamo Ampere-Hour Meter.

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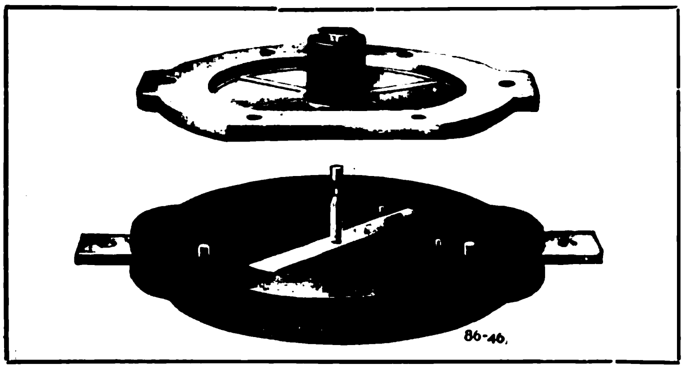
tical walls of the insulation block, is filled with mercury.

In the mercury chamber, below the insulation block, is the copper disc or armature, on which is mounted a float. The float and disc are mounted on a shaft that is set in a jewelled guide in the centre of the pole plate, and the upper portion of the shaft, above the float, passes through a tube, the lower portion of which is very close fitting, and upper portion of which is enlarged. The smaller part of this tube is designated as the mercury tube, and the upper, or larger part, the shaft chamber. By noting the diagram the reader will observe that the design of the mercury chamber is such that no matter in what position the instrument may be placed the mercury will not escape, and there is so slight clearance between the shaft and the mercury tube that there can be no leakage.



Resistor Element of the Sangamo Variable Resistor Ampere-hour Meter.

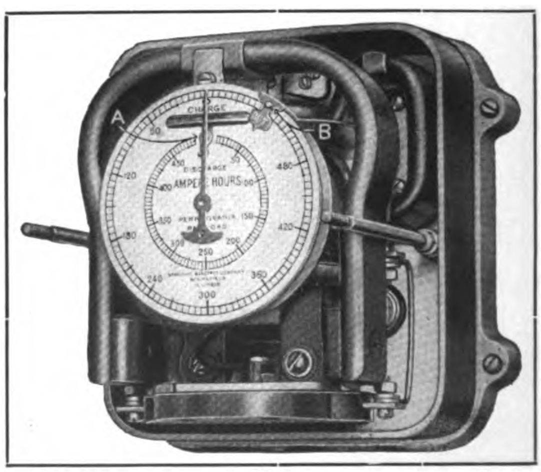
The hopper cap carries two arms, and above these is what is known as an arch, in the centre of which is a jewelled bearing, adjustable by a screw, in which is set the upper end of the vertical shaft. On the shaft, above the hopper cap, is a worm, and above this is a sleeve that carries a damping disc that is set in insulation. The vertical shaft would be carried on the lower bearing in the pole plate were it not for the mercury in the chamber and the float attached to the copper disc armature. The specific gravity of the mercury is so much heavier than the armature and the float that the tendency of these is to rise, which brings the upper end of the shaft against the jewelled bearing in the arch with a pressure of 1/10 ounce, and there is no weight carried by the lower bearing.

One will assume that the mechanism is extremely delicate and that it will not endure the shocks and vibrations of the road service of a vehicle, but these are all absorbed by the mercury, so that there are no stresses upon the instrument and it will record with extreme accuracy.

On the shaft below the damping disc is a worm, and this engages with a worm wheel that is supported by a bracket attached to a web formed in the hopper cap. The operation of the instrument is as follows: The permanent magnet maintains a magnet field of flux at right angles to the copper armature that is floating in the mercury in the chamber. The electric current enters at the left contact ear for instance, and passes out at the right contact ear. The armature revolves from right to left in this case and the magnetic flux moves from left to right. As the armature moves the worm on its shaft turns the worm wheel that is coupled with the train of gears that operates the recording dials, and the indications are made on the dials in ampere-hours, or, if desired, with such other detail as may be essential. Generally the record is 100's, 1000's, 10,000's and 100,000's, with the ampere-hour as the unit. In the accompanying diagram the recording mechanism, the field magnets and the damping magnets have been removed to simplify the illustration. Incidentally, with an electromagnet substituted for the permanent driving magnet the instrument becomes a watt-hour meter that will register by watts all the current that is passed through it.

The advantages of the mercury flotation system are regarded as being very important in that they are claimed to affect every phase of design of the meter and to satisfactorily meet conditions that were believed to be impossible in other types of meters. Among these advantages may be included the following: That the bearing pressure, under absolute control of the designer, is reduced to an absolutely negligible value; that the bearing pressure, being absolutely independent of weight of the moving system, affords the designer great freedom in meeting many of the difficulties experienced with other types; that the torque, being independent of bearing pressure, can be made high without affecting the durability of the instrument; that the weight being no limitation, the ratio of torque to friction can be made so large that friction under all conditions of load is negligible, and that the armature disc being immersed in mercury serves as a buffer to absorb all impact forces and thus prevents damage to the bearings, even when the meter is subject to severe shocks.

As the general design of Sangamo ampere-hour meters is intended for measuring current in excess of 10 amperes, those having greater capacity are made with shunts. Instruments rated at 10 amperes will carry more than 100 per cent. overload continuously, but for the purposes of calibration the meters rated at 10 amperes and upwards are handled by using shunts. The circuit diagram of a simple shunted meter is shown in which the main or line cur-



Sangamo Variable Resistor Type Ampere-Hour Meter with Cover Removed, the Contact at "A" Stops Further Charging and Contact at "B", After Slight Discharge, Restores Normal Operation.

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rent to be measured passes through the shunt, and a part proportional to the drop across the shunt, that is, the part which is a definite proportion of the total current, is shunted through the meter and measured. The arrangement of the gearing and the calibration of the dials of the meter so that it takes into account the ratio of the shunted current to the total and reads directly the true ampere-hours in the main circuit is a simple matter.

Obviously, from examination of the diagram, and knowledge of the meter, the only effect of reversing the current would be to reverse the direction of the rotation of the meter, and that it will read the true ampere-hours in both directions.

In battery operation the same number of ampere-hours that are put into a battery cannot be taken out, and for that reason were the simple shunt ampere-hour meter used for repeated and successive charges and discharges, the pointer must be reset at zero each time the battery is fully charged, to obtain a true indication of the condition of the battery. When the meter is fitted with a charge-stopping device the pointer may be reset while charging to provide for a predetermined ratio of overcharge.

This zero contact or charge stopping device consists of a solenoid trip circuit breaker that is actuated by the pointer closing when it arrives at the point of full charge that has been established by the operator in advance. The circuit breaker also breaks the exciting circuit so that it carries a current only for an instant. This is claimed to be the only logical and satisfactory method of stopping a charge, since the opening of the circuit cannot take place until the predetermined number of ampere-hours have been absorbed by the battery or have been drawn from it.

Statement has been made that a battery will absorb more electric current than can be drawn from it in operation at working voltage and utilized, for which reason a battery is usually given a charge of more amperes than was taken from it. As in practically all work to know how much can be taken from a battery is more useful than to know how much has been charged into it, a meter that automatically allows a reasonable ratio of overcharge serves an extremely satisfactory purpose. Such a meter indicates at all times the quantity of electrical energy available without setting the pointer every time the battery is charged. That is, the battery and the meter may be kept in step for a considerable period without readjustment.

The design of the Sangamo differential shunt meter is to meet these requirements. It consists of a Sangamo meter with two shunts connected, as is shown in an accompanying diagram. The relative value of the shunt resistance is adjustable by means of the slider G, so that the meter can be made to run slow on charge or fast on discharge, according to the needs. Usually the meter is set to register less than the true quantity of current on charge and the exact quantity on discharge, the difference representing the loss in the battery or the overcharge. With the charge-stopping device that is shown in another diagram the battery can be given an amount of overcharge that can be determined by the setting of the slider G. With the differential shunt meter the value of the overcharge can be fixed in advance by a skilled man and the actual charging done by an inexperienced person, since all that is necessary is to make the connection and leave the instrument.

In installations where the battery is "floated on the line," that is, where the load current may either come from the battery or generator, the differential shunt meter cannot be used, since if the current were taken from the generator it would pass through both the legs of the shunt in series. With this condition to automatically overcharge a battery a different method has been adopted. In such a need there is introduced into the motor element circuit, either in parallel or series with the motor element, a resistor that has two distinct values of resistance, one for each direction of the current. The character of this resistor is shown in an accompanying illustration. A diagram also shows the connection of the resistor in series with the motor element.

The resistor is an adaptation of the mercury motor principle, and consists of a copper bar pivoted and floated in a mass of mercury, its rotation being limited by two stops. The magnetic field is supplied by the same poles that produce the fields in the motor element. In one position the copper bar is in direct line between the contacts, while in the other position the bar is at an angle to the contacts, and the high-resistivity mercury path is longest, so that the resistance is maximum. In practise the vane is usually arranged to decrease the current through the motor element on charge, and increase it on discharge, thus causing the motor to run slow on charge and thus afford automatically the desired overcharge.

This automatic resistor can be applied to any shunted meter of 20 amperes or greater capacity, and when used with a 20-ampere meter, which is the least favorable condition, it will be extremely accurate down to two amperes, and fairly accurate to one ampere, while it will carry an overload of 100 per cent. with but little decrease in its normal accuracy.

(To Be Continued.)

LIMA LIGHT DELIVERY TRUCK.

A light delivery car is to be produced by the Lima Light Car Company of Lima, O., and it will be sold for $500. It will have a block cast, valve-in-the-head motor, in a unit power plant that will include the clutch and gearset, and the drive will be through the ordinary type of bevel gear rear axle. The wheelbase will be 100 inches and the tires will be 28 by three inches. I. J. Miller is president of the company, C. E. Miller the vice president and A. C. George the treasurer.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. MAY, 1915. NO. 5.

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Information given on request. All advertising copy must reach this office not later than the 25th of the month preceding.

Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

Entered as second class matter, Feb. 25, 1911, at the Postoffice at Pawtucket, R. I., under the Act of March 3rd, 1879.

TRUCK MANUFACTURERS' CONVENTION.

The convention of manufacturers of motor trucks at Detroit, Mich., May 5 and 6, organized by the commercial vehicle committee of the National Automobile Chamber of Commerce, while it did not determine any policies other than to establish a decided attitude unfavorable to service vehicle exhibitions, was of undoubted benefit to the industry. Until that convention there had been no disposition of the members of the N. A. C. C. to confer with those of the industry who were not affiliated, especially with reference to business policies.

The association, with admirable judgment, invited all who cared to to join in the deliberations, with a view of learning from all, if possible, opinions that might be crystalized into definite policies, and to unite so far as practicable on subjects in which all had more or less joint concern. The invitation was general and a considerable number of unaffiliated firms participated in the proceedings, their representatives being cordially received and their views solicited, with the result that following careful deliberation of three very important subjects—service, time payments and shows—the convention, after the appointment of a committee to formulate a service policy, unanimously agreed to hold another session early in the autumn for the purpose of acting upon a report of this committee.

The convention was well organized, and it considered the problems before it with candor, and while there was no disposition to temporize, there was belief that whatever was decided upon should be well considered and the effect upon the purchasers forecasted, that there should be no weaknesses and the buyers of machines would feel that their interests were protected so far as there was any legitimate reason for protection.

This was the first time in the history of the industry that all connected with it felt free to meet upon a common ground and discuss business for the general good, and the spirit of fairness and co-operation manifested will go a long way toward the development of an organization that ought to be devoted exclusively to the promotion of the use of motor wagons and trucks. There is no doubt that in a comparatively short time that the needs of such an association will be more keenly felt, and with a clear understanding and confidence in each other the manufacturers can join in their endeavor for whatever purposes may appear best. There may be those who will criticise the result of the convention, because it did not dispose of many problems and unite on definite policies, but these are of such proportions that the delegates were entirely justified in conservatism and taking whatever time may be necessary to determine them equitably and fairly. As the movement has been inaugurated, the industry will work out its own destiny. What was more needed than all else was confidence and a realization of the possibilities of co-operation, and one can safely affirm that with these established unity and progress will quickly follow.

ECONOMIES THROUGH ACCOUNTING.

Every business man maintains record of his commercial or industrial transactions that he may so regulate his sales or production that a satisfactory profit may be made. He will not question the value of accounting as applied to his business as a whole, but he will frequently neglect or refuse to learn what will obtain the greatest economies from his transportation department. There is apparently no reason to reject a saving, which may justly be regarded as a profit, in haulage, for this is equal to increasing business with no possibility of loss or shrinkage, yet the average man will not accept a certain economy, but will turn to what will add to his responsibilities, increase his investment and is an uncertainty at best. He understands the practicality of records, but will not use them to his own advantage.

EXPLOITATION OF FOREIGN MARKETS.

Although during the first months of the European war there was much comment on the possibilities of developing the markets of neutral nations, seemingly but little progress has been made in this direction by any of the commercial or industrial associations, and practically none by individuals. Aside from large sales of trucks to combatants, which are a necessity and must be had at any price, there has been nothing done to promote foreign business, and apparently there is a reluctance to undertake such promotion.

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G M C SELLING AND SERVICE POLICY.

Simple Standard Construction of Trucks Enables Outside Garages to Do Work Satisfactorily—Minor Parts May Be Purchased Elsewhere.

OF ALL the manufacturers of motor trucks who have sought to readjust the conditions of "service to owners," none has a more interesting experience than the General Motors Truck Company, Pontiac, Mich., which sought to bring about betterment by the establishment of an entirely different policy than had previously obtained. The company reached a conclusion that the basis of its transactions was entirely wrong, the situation causing quite as much dissatisfaction for the owner as for the dealer, and to relieve this and to eliminate any uncertainty and embarrassment, it made its preparations and anounced that its selling policy would be radically changed.

The experience of the company was that men while making inquiry and investigation prior to purchasing trucks had been misled, intentionally, possibly from desperation of salesmen who believed their positions depended on making sales, or unintentionally by salesmen who were not well informed and through sheer ignorance obligated the company to all manner of conditions, many of these being unreasonable and unjustified by business dealing or precedent. Another condition was that buyers who desired to drive sharp bargains often exacted from dealers concessions that were far beyond the warranty of the manufacturer, the dealer, in fear of competition and realizing the advantage of having machines in operation, literally throwing away his profit and some of his capital.

The G M C Sales and Service Station in Philadelphia.

There was still another aspect when the motor truck industry was young, many manufacturers built and sold machines that were experimental. The purchasers of these vehicles had no knowledge or information to guide them and with the crude constructions the operating costs were excessive, the upkeep much more than had been estimated by theory and the interruptions from defect and failure were numerous and discouraging.

The experience of the first truck buyers was frequently unsatisfactory and many of them went back to horses, giving the motor truck, naturally, as a result of their experience, a very bad reputation among their business acquaintances.

But it was not long before designs had been perfected, experience greatly improved the materials of which the trucks were constructed, and the growing size and importance of the motor industry made it profitable for steel manufacturers to specialize on motor car materials.

All these forces so improved motor trucks that the industry rapidly reached a state where its products were as dependable as any other sort of standard machinery—locomotives, or trolley cars, or automatic tools. Yet the truck user, remembering his early experience, could not be convinced immediately that the machines were perfected and dependable.

In order to make sales many manufacturers established service departments and promised, in effect, to keep their trucks in constant operation or to supply, when they were not in operation, substitute trucks to take their place.

This was a promise which the manufacturers and their agents could not, with due regard to the profits from their business, afford to make. It was a policy, moreover, which no concern manufacturing machinery could consistently carry out, and one that has never been attempted to anything like the same extent by manufacturers of analogous products.

After the buyer has been educated to large expectations of free repairs it is very difficult for any individual maker to alter the buyer's conception of what was due to him without incurring dissatisfaction.

The General Motors Truck Company, however, accomplished this by a bold stroke. It announced large reductions in the prices of its trucks, and at the same time stated that in consideration of this reduction it would abolish all "free service" in the sense of supplying material or labor for repairs, except such as is

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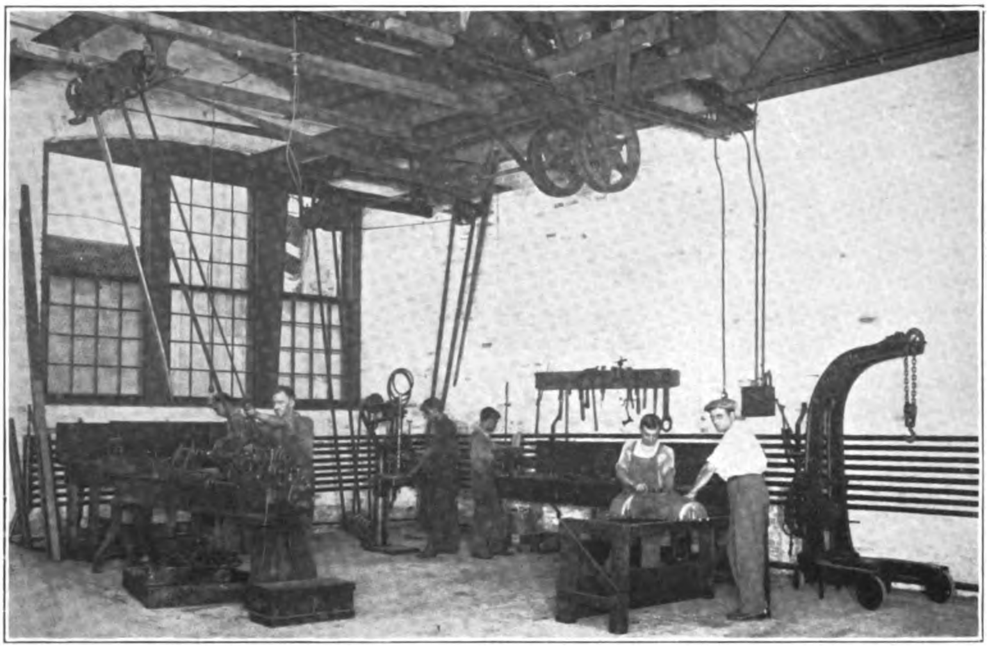

Machine Tool Department Where Quick Work Is Done.

The same policy is followed with regard to repairs. If there is near the owner's establishment a small repair shop, operated with little overhead that can turn out good work at a lower price than the company, it is glad to have the owner go there.

If a truck is out of commission for a time or an extra truck is needed by a customer and one can be found outside of the service station the customer is entirely free to secure its services rather than going to the branch or dealer who sold him his car.

Special relief trucks kept by the service station are necessarily idle a large part of the time tying up investment, using up garage space, and employing a driver only irregularly. So the company desires to have no more of them than necessary and when one is required by a patron, it feels in view of the price at which his own truck was bought that it must charge at a rate that will cover all the factors of cost that enter into affording the service.

In short, the company is in the business of making and selling motor trucks, rather than in supplying repairs and maintenance, and of that latter business it wishes to accept from its customers no more than is necessary to insure the successful and profitable use of their trucks.

This attitude helps in gaining the confidence of the owner in any recommendations that may be made regarding the care and maintenance of his truck. The owner is convinced that the only motive of the company in offering him advice is to assure satisfactory results from the truck. And yet he knows that if he

covered by the 90-day guaranty against defective workmanship or material.

No Promises as to Service.

The company makes no promises whatever regarding service when it sells a truck. But as a matter of fact it maintains travelling inspectors, who examine the trucks periodically, instruct drivers for two or three days after a truck is delivered, and make suggestions regarding the operation and maintenance of the machine from time to time. Or, if the owner prefers, he may run his truck into one of the company's service stations such as that at 203 North 22nd street, Philadelphia, Penn., and have it inspected over there.

As the company puts it, no promises can be made, but the owner can always turn to the company for aid and comfort and technical advice. The company does not urge that all work on its trucks shall be done in General Motors Truck stations. It is entirely satisfied if the owner can with convenience to himself have his repair work done elsewhere or even buy parts from other sources.

To make that practical extremely simple designs have been adopted for all trucks it builds and these are such that any good mechanic, not specially trained on G M C trucks, can do all the work necessary upon them. In fact, any good mechanic is competent to keep any G M C truck in shape.

Many Standard Parts Used.

In the same way and for the same reasons, as many "standard" parts as possible are used on the truck. That is, bolts and nuts and pins of a type that can be bought at any hardware store are used whenever practicable.

And the owner is frankly told that the hardware store can do business more cheaply, because of its smaller overhead than the General Motors Truck Company, and that some saving in cost can be made by buying such materials from a hardware store rather than at one of the truck company's branches.

Stock Department in Which Parts for All Models Are Kept.

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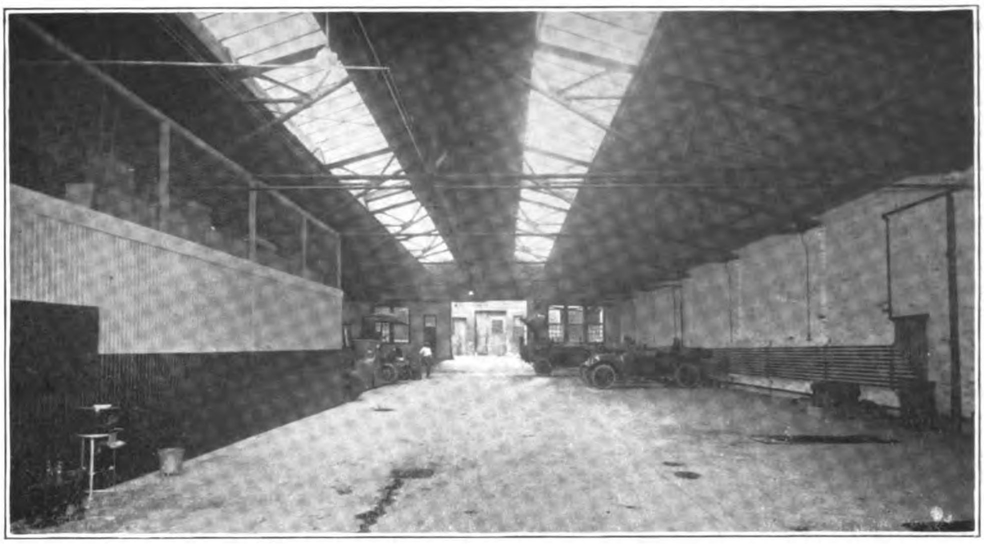
desires any work done by the company it will be done as promptly as possible and in a thoroughly workmanlike way.



Garage Where a General Storage and Supply Business for Trucks Is Done.

The Philadelphia branch of the General Motors Truck Company is located in a new garage at 203 North 22nd street. The entire business is on one floor. The sales rooms and branch offices are in the front at the north side of the building. Behind these and running half way to the rear of the garage are the stock rooms, where complete supplies of repair parts for all models of G M C trucks, both gasoline and electric, are kept.

At the rear of the garage is a section given over to shop work which contains a lathe, power drills, crane and work benches.

The direction of all the repair work at the station is in the hands of a factory-trained superintendent, who has been engaged in building and maintaining machines since trucks have been sold.

When a truck comes into the station he goes over it in detail, noting its condition and making out a list of repairs that should be made upon it to restore it to perfect operative condition. This list is submitted to the owner of the truck for his O. K., and when authorization has been given the work is carried out under the immediate direction of the superintendent.

Handling of the Stock Department.

The repair parts department is in charge of a competent stock clerk, who issues parts only on requisition and who is responsible for keeping the supply of parts on hand complete and as large as the branch at any time is likely to require.

A running inventory of the stock is maintained by the method of issuing parts. A card record system is used in which there is a card bearing the name of each part, its number and its list and net prices. Each side of this card is divided into three sections, one of which is used for recording the receipts of parts and the other for entering disbursements. As soon as a requisition is filled the amount is entered on the card and the balance on hand in the bins kept constantly up to date. The stock room is divided up into sections and the sections into bins. Each bin is marked with the part number, and both the part number and the section number are carried on the perpetual inventory card in the file. So that a glance through the card system will tell instantly where a part is to be found.

Can Build Machines from Stock.

The stock of parts kept in Philadelphia ranges in value from $18,000 to $25,000, and complete trucks could be supplied from it if necessary. It contains not only the special parts used only in General Motors trucks, but also the standard parts which can be bought anywhere.

Once a year a direct inventory of the stock is made, every bin being emptied and its contents counted to verify the results shown by the perpetual inventory. The result of this inventory is written out on a green card, and tacked to the front of the bin along with the bin number, the number and description, such as for instance, "capscrew, 5/16 by 2½, standard."

Parts are arranged in the stock room in sections. One is given over to "standard" parts; one to heavy

G. M. T. Company Service Report—Electrical Equipment

Model______ Chassis No.______ Date______

Firm______ City______

	Hours
Demonstration	
Installation	
Inspection	

	Hours
Miscellaneous	
Mfr's Guarantee	
Time Charged	

Amount Charged
Owner's Signature

PART NAME	Found O. K.	Has been Adjusted	Will need Attention	State about care and condition of truck:
Meter				
Safety Switch				
Controller				
Resistance				
Wiring				
Gong				
Steering Gear				
Front Springs				
Front Axle				
Front Wheels				
Front Wheel Bearings				
Brake Pedals				
Batteries				
Countershaft				
Sprockets				
Chassis				
Rear Springs				
Rear Axle				
Rear Wheels				
Rear Wheel Bearings				
Brakes				
Motor				
Distance Rod				

Fill out this Form in Duplicate for every Individual Chassis inspected or repaired. Mail original (Pink Sheet) to Home Office properly signed by Owner. Deliver Copy (Buff Sheet) to Owner.

Sign Here______

Inspector's Report on Condition of Electric Trucks.

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FORM 088-3-10-14 2M 8878

ORIGINAL TO CUSTOMER

GENERAL MOTORS TRUCK COMPANY

CUSTOMERS INSTRUCTIONS FOR REPAIR WORK

OWNER ____________________

ADDRESS ____________________

MODEL ________ CHASSIS NO. ________ ENGINE NO. ________

DATE TO BE COMPLETED ____________________

INSTRUCTIONS

YOU ARE HEREBY AUTHORIZED TO FURNISH ALL MATERIALS AND LABOR NECESSARY TO MAKE THE ABOVE REPAIRS

SIGNED ____________________

DATE ____________ JOB NO. ____________

COMPLETED ____________ 191__ ____________
DATE FOREMAN

ADDITIONAL AUTHORIZATION MUST BE SECURED BEFORE PERFORMING ANY WORK NOT SPECIFIED ABOVE

Repair Instructions Signed by Owner.

duty parts for 3½ to five-ton trucks; one for 1¼-ton truck parts; one for two-ton parts; one for 1500-pound truck parts, and one section is fitted with parts for the electric models which come in eight sizes. However, a great many of the parts for the electrics are interchangeable and can be used on any one of the eight models.

Charges for Labor and Materials.

All labor and materials used on any truck are entered upon a cost sheet, which is made out in triplicate. The costs are not divided into various departments, such as motor, transmission, rear axle and so on, but are charged merely to the job.

Each workman has his own time card, which he punches in a time clock when he starts a job and when he completes it. From this card and the requisitions for material the cost sheet is prepared. One copy goes to the owner or his representative for approval, another to the accounting department for billing purposes and a third is kept on file.

System of Inspection.

The inspector for the trucks in the territory operates from the branch, but a travelling inspector works also from the factory. He comes into the branch territory at request to take care of a special installation that may need attention.

He examines a truck, carefully noting its condition and the need of repairs, advises the driver or master mechanic in charge regarding its condition, and sends a report made out in duplicate to the branch. This report carries information of what he found relative to the need of attention, whether or not he was able to make repairs or adjustment on the spot, or whether it will need further attention. One copy of his report is kept on file at the branch for future reference and the other copy is sent to the truck owner for his information.

The company does not take the position that a trained or high-priced mechanic is necessary for the successful operation of its trucks. The simplicity of construction of the machines is such that a man of ordinary intelligence, after the instruction given by the truck demonstrator, should be able to care for them with good results.

The instructor remains with the truck until he feels that the driver is capable of handling it, but not longer usually than three days. In the case of a man who has had previous experience driving trucks, this time may be much reduced. As the number of trucks increases and a class of professional truck drivers is developed and the reliabliity and simplicity of the truck is improved, the matter of securing satisfactory drivers is solved more easily.

LEST WE FORGET

GMC

TRUCKS

664 N. BROAD ST.

Heading of Memorandum for Shop Instruction.

At the same time service departments in touch

FORM 0270 12-30 5M N R P CO

SEC. ________

BIN NO.

NAME OF PART ____________________

LIST EA
NET EA

USED ON MODELS

RECEIPTS					DISBURSEMENTS											
DATE	REC SLIP	QUAN.	$	CTS.	DATE	ORDER	QUAN.	O.H.	$	CTS.	DATE	ORDER	QUAN.	O.H.	$	CTS.

Card Used in Maintaining Perpetual Part Inventory.

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with truck owners report that previous experience with trucks which many owners have had is making the matter simpler. Most of these owners now realize that a truck needs more attention than a horse wagon, and that if they are to get the best results and the largest return upon their truck investment they must make it possible for their truck drivers to keep their machines in condition.

The practise of allotting a certain period every week to the thorough adjustment and oiling of the truck, and of a certain shorter period every day to like work, is increasing. In short, truck owners are learning that it may in the end be as expensive to run a truck that is not kept in good condition as it was to overwork or mistreat horses.

The G M C station in Philadelphia looks after service work for from 75 to 100 trucks that have been placed in that territory. It does a garage business in addition to its service and sales work, but does not make any monthly contracts for maintenance, charges being divided into bills for gasoline, oil and garage service, and for repair work in cases where an owner prefers to have all his work attended to at the service station.

GEAR DRIVE MAKERS ORGANIZE.

Makers of internal gear driven trucks have combined to forward their mutual interests under the name of the Internal Gear Drive Association, with headquarters at Detroit.

George M. Davis has been made the acting head of the organization, the purpose of which is said to be to supply a clearing house for information desired by members of the association and to conduct an educational campaign directed at users and dealers. There is no intention, it is said, to conduct a fight against other types of gear drive.

In the association are the Republic Motor Truck Company, Alma, Mich.; Denby Motor Truck Company, Detroit; the Russell Motor Axle Company, North Detroit; the Torbenson Gear and Axle Company of Newark, N. J., and the Celfor Tool Company, Buchanan, Mich.

MODEL TRAFFIC REGULATION SOUGHT.

The central committee on street traffic and safety, appointed by Mayor Mitchell of New York, has named a sub-committee consisting of representatives of every interest that uses the streets of New York, to draw up a model traffic ordinance.

Automobile associations are well represented. Among the members are: R. H. Johnston, Automobile Dealers' Association; J. S. Marvin, National Automobile Chamber of Commerce; D. C. Fenner, Electric Vehicle Association; T. D. Pratt, Motor Truck Club of America; Maj. H. C. Wilson, Society of Automobile Engineers, and Elmer Thompson, Automobile Club of America.

IS SECOND-HAND FLOOD COMING?

European motor manufacturers are much concerned over the disposal to be made of the motor vehicles, especially trucks, that are now used in such enormous quantities by the armies of Europe. At the beginning of the war practically all the machines of either commercial or passenger type that could be found were commandeered.

Since then every European factory and many in the United States have been running at capacity to supply additional vehicles. This will continue probably until the end of the war. It will be impossible then for the governments to keep the vehicles for which they will have no use and which would rapidly decrease in value through becoming obsolete.

The result, as English experts see it, will be that the machines will be sold to speculators or at auction for very low prices. The European market will be glutted, and manufacturers fear disrupted, by the flood of cheap used vehicles, and production may be brought to a standstill.

America's distance will possibly prevent this condition from affecting it to any great extent. But it is more than probable that thousands of these machines will be shipped to all quarters of the export market, in the opinion of English motor experts.

BOSTON TO GET MAIL TRUCKS.

Bids are to be opened by the postmaster-general May 27 for 15 motor trucks to be used in carrying mail in Boston. These machines will be used to supplant the mail service now afforded by the Boston Elevated Railroad Company. The new system will be installed July 1 and will be continued for two years. Postmaster William Murray believes that the motor truck service will result in a saving of $50,000 a year over the present system.

Thirteen of the machines will be 2500 pounds capacity and will be used for transfer service between mail stations in the Boston district. Two will be 1500 pounds capacity and will be used for parcel post collection and delivery between the stations.

NEW GOODYEAR GUARANTEE.

A new truck tire guarantee by the Goodyear Tire and Rubber Company, Akron, O., has been announced by C. W. Martin, Jr., manager of the truck tire sales department. For the next three months buyers of S-V tires are guaranteed that if their tires do not outwear competing tires by yielding lower cost per mile, the entire purchase price will be refunded.

The conditions are simple and are outlined in the agreement made at the time of the sale. S-V tires are to start running on the same truck in the same positions as competing tires, S-V's must be of the same size as competing tires and these latter must be a regular product purchased in the open market.

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UNITED STATES COLLECTS ROAD DATA.

Information is being gathered by the United States Department of Agriculture which, when complete, should not only give the total mileage of public roads in the United States and their cost, but should also serve as a basis for estimating the value of the various kinds of highways that are being built throughout the country.

Some 15,000 sets of inquiry blanks have been distributed through the state highway commissions. These are now beginning to come back to the department, so that the information can be tabulated. Each consists of four cards. Of these the first asks for mileage of various kinds of roads in each of the counties to which it is sent.

The mileage does not include the streets of cities or towns. Roads have been divided into 10 classifications: Brick, concrete, macadam with the addition of some substance such as tar, oil, asphalt, plain macadam, gravel, shell or other hard surfaced roads, sand and clay mixture properly graded and drained, ordinary earth roads properly built and unimproved roads.

The second blank asks for facts concerning the tax rate and the amount of money spent upon roads. The third is to be filled in with the names of local road officials and the fourth with facts regarding bond issues and the indebtedness incurred by counties in the interest of their road systems.

It is not expected that this preliminary survey will be exact, owing to the fact that there are 3000 counties in the United States, in many of which the road mileage has not been previously estimated.

The department already knows, however, that the average length of road for every square mile of territory is .80 mile, and that it ranges from .50 to 2½ or three miles in the most improved sections of the country.

This investigation will be continued year after year, so that from the results shown the durability and economy of various types of construction may be established.

PHILADELPHIA BUYS 22 MOTOR ENGINES.

Contracts for $100,000 worth of motor fire apparatus have been placed by Director Loeb of the Philadelphia Department of Supplies. The order was distributed as follows: Two aerial trucks, two city service trucks, two combination wagons and five tractors for old engines, total $55,000, to James Boyd & Brothers; two electrically propelled combination hose wagons, one electrically propelled tractor, total $14,800, to the Commercial Truck Company of America; one tractor for engine, two tractors for aerial trucks, $11,000, Front Drive Motor Car Company; one pumping engine, $8200, Ahrens-Fox Fire Engine Company; four combination hose and ladder wagons, $18,743, International Motor Company.

PRESENT AMBULANCE TO FRANCE.

Col. R. H. I. Goddard and the Franco-Americans of Rhode Island have received from the Monahan Vehicle Company of Providence, R. I., a Red Cross ambulance, which they have presented to the French Red Cross.

The ambulance is mounted on a four-cylinder White chassis with dual pneumatic tires at the rear. There are four longitudinal cots in the body. The upper cots swing down so that they can be used as backs for seats formed by the lower cots when patients are carried in sitting positions.

There is a compartment at the front of the interior for medicine and supplies and a folding seat for the surgeon. A water tank is located in front for emergency uses. The rear steps are enclosed to protect patients from wind and mud when they are carried sitting on the steps and straps are provided to hold badly wounded men in place there.

Stretchers are provided for each cot. There are two folding litters, one of which is placed on the floor of the ambulance and the other on a level with the lower cots.

Red crosses are displayed on each side of the body and those on each side of the driver are so arranged that they are visible through the side lights when the car is seen from in front at night. There is another on the roof of the car to inform aviators of the use made of the machine. At each corner of the roof are Red Cross flags.

At the front above the roof is a small placard in French to this effect:

"Presented to the society of rescue for the injured military of France by Col. R. H. I. Goddard and the Franco-Americans of the State of Rhode Island, United States of America, May, 1915."

The Rhode Island state seal is placed on each side in round plaques. The car is painted battleship gray, the common color for army vehicles.

NEW CHASE MANAGER IN PHILADELPHIA.

J. A. Inness, a Chase representative in the early days of the industry, has assumed control of the Chase Motor Truck company's branch in Philadelphia, leaving the Philadelphia truck department of the Chicago Pneumatic Tool Company for that purpose. He succeeds A. E. Fisler, who resigned to enter another line of work.

Extensive improvements are being made in the Philadelphia branch. A complete service station is to be installed and all the territory in eastern Pennsylvania, New Jersey, Delaware and Maryland will be handled from Philadelphia.

Wickham Brothers of Scranton, Penn., who have used Chase trucks in their own business for a long time, have undertaken to represent that product in the territory about Scranton, Penn.

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PRACTICAL MOTOR TRUCK MECHANICS.

Drivers not mechanically trained do not understand that there are right and wrong ways of placing wires on a battery or coil terminal. The proper method of attaching a cable is to twist the bare portion around the post in a clockwise direction and then

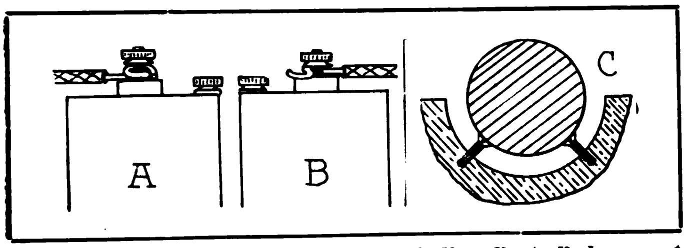

Fig. 5—A, Correct Turn of Cable on Binding Post; B, Incorrect Turn of Terminal Wire; C, Alignment of Shaft When Babbitting Bearings.

tighten the terminal nut. It will be noted by referring to Fig. 5 A, that the reason for this is that as nuts have a right thread, tightening tends to closer twist the wire to the terminal. If the wire be twisted in the opposite direction, as in Fig. 5 B, turning the nut to tighten it may uncoil the wire, so that the supposed firm contact is not tight and the continued vibration of the machine will loosen the nut.

SUGGESTION FOR BABBITTING BEARINGS.

Pouring babbitt linings in the bearing boxes is not difficult, but the preparation often entails much care to insure correct alignment of the shaft during the operation. The simple method illustrated at Fig. 5 C will save much time and labor in shaft aligning. This requires two holes drilled in the box about 90 degrees apart and about ¼ inch from the outside surface. Tap these holes for countersunk head screws. When the shaft rests upon the heads of these supporting screws it can be easily lined by raising or lowering either or both of them, according to the conditions. If the threads have been liberally coated with oil, the screws can be readily removed after the metal has been poured. This method also has the desirable advantage in that the shaft may be removed for heating purposes with the assurance that it will be in line when replaced.

CLEANING ACETYLENE PIPES.

Those who operate machines equipped with acetylene gas generating systems are sometimes seriously inconvenienced through the piping from the generators becoming obstructed, wholly or in part, the headlights often failing or becoming inefficient when needed. Gas generation is not always a choice with owners, who, because of conditions, find that this system is the most positive to operate, especially if stations for the exchange of gas tanks are not numerous. Carbide can always be carried and with reasonable care the lights will afford good satisfaction.

Efficiency, however, can only be obtained by blowing out the piping at least once a week by attaching a tire pump to the tube where it is connected to the generator. When cleaning the pipe the burners ought to be removed so that particles of carbide may be blown out. Some operators fit sections of fine mesh screen over the outlet of the generator to prevent carbide from being carried into the pipe. When the burners are obstructed they can usually be quickly and efficiently cleaned by holding them with pliers over the outlet of a compression relief cock while the engine is running, which will cause the pressure from the compression stroke of the engine to force the carbide particles through the burner outlets. This operation is illustrated at Fig. 6 A.

AN IMPROVISED TUBE PRESS.

When making a roadside repair of a tire, it is often found necessary to subject the tube and the patch to pressure until the cement can thoroughly set. An easily constructed press for this purpose is illustrated in Fig. 6. Two blocks of wood (B), about four inches wide, six inches long and two inches thick, and an ordinary jack which forms part of the equipment of every car are required. After the patch has been carefully applied the tube (C) should be placed between the two blocks and the jack (D) mounted on the top block. A strong piece of cord or preferably wire (E) should then be passed around the blocks and over the head of the jack. By raising the jack the wire will be drawn tight and cause the necessary pressure for the repair.

AN ADJUSTABLE SOCKET WRENCH.

An adjustable socket wrench is a tool that is absolutely necessary in any repair kit. The wrench illustrated in Fig. 7 is not difficult to make and is a very satisfactory tool wherever it can be used. To make

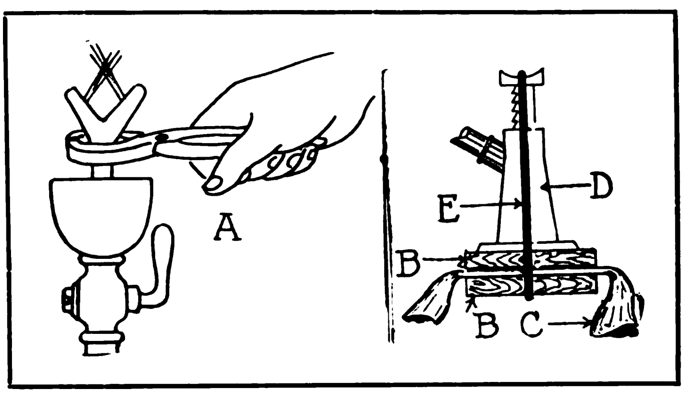

Fig. 6—A, Cleaning Acetylene Burner at Compression Relief Cock; B, C, D and E, Members of Improvised Tire Tube Press.

this a strong piece of band steel is bent in the shape shown at "A," and in this is drilled and filed a square hole at the point "B." A square piece of iron "C" is

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then fitted in the hole and a band is riveted to the lower end of it. A handle is then welded at the top. It will be noted from the sketch that by applying pressure on

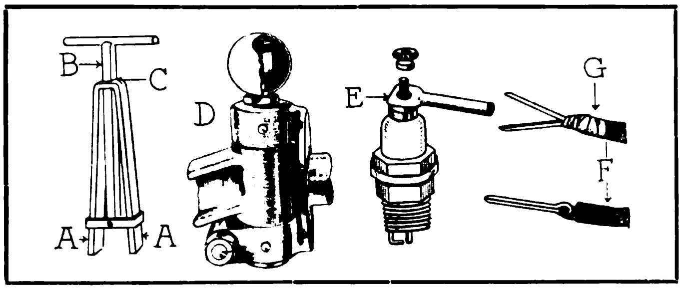

Fig. 7—A, B and C, Members of Home-Made Adjustable Socket Wrench; D, Protection for Oil and Grease Cups; E, F and G, Components of Improvised Quick Detachable Terminal for Wiring.

the handle the wrench will adjust itself to the nut. This device can be made in various sizes to meet the requirements of the work and the size of the materials used can be varied to possess the requisite strength.

PROTECTION FOR OILER.

Many oil and compression grease cups are fitted on chassis where dirt and grease can accumulate about them. Unless very carefully removed some of this foreign matter may get into the cups and then be forced into the bearings. Very frequently mud will be deposited on the threads of the cups and obstruct the turning of the caps by which the lubricants are fed. A good protector can be made for any small oil or grease cup by obtaining an ordinary rubber ball and cutting a small round hole on one side. The ball can then be passed over the cup and the pressure on the collar or nut at the base will effectually retain it. The ball covers can be painted to match the chassis and are by no means unsightly. The illustration, Fig. 7 D, will serve to make the method of application clear.

IMPROVISED CABLE TERMINALS.

Fittings that are trifling in cost and are used in numbers on chassis are often indispensable, and should these be lost or broken or badly worn, the driver may have to improvise what will serve until replacement can be made. The experienced motorist will meet conditions that have caused failure and make temporary restoration with surprising cleverness, some of these repairs being so well done that they can be continued without change. An example of an improvised cable terminal is shown at Fig. 7 E, which is far more serviceable than merely wrapping the wire about a binding post.

A piece of copper tube is flattened for a half inch of its length, and in this flat section is drilled a hole that will fit the terminal to which it is to be attached. A cotter pin that closely fits the internal diameter of the tube is soldered to the end of the cable, as is shown at Fig. 7 F, and the end is bound with tape to insulate and strengthen it. The halves of the cotter pin are then spread slightly in the manner seen at Fig. 7 G, and when these are forced into the tube a very good electrical contact is made, and the pin can be withdrawn easily, although it cannot be shaken loose.

REMOVING WHEELS WITHOUT A PULLER.

When the removal of a rear wheel is necessary the driver must borrow or buy a wheel puller. This is the best and most satisfactory tool to use, but in an emergency a wheel can be started by applying pressure to it and then striking the axle a sharp blow. When a puller is not available two men can remove a wheel by the method illustrated in Fig. 8. The hub cap and the retaining nut on the end of the axle should be taken off. One man should grip both sides of the wheel and pull it hard towards him, while the other strikes the end of the axle with a block of wood. Never strike the end of the axle with any metal tool, as this may damage the thread. Generally a few blows will loosen the wheel so that it can be drawn from the shaft.

STICKING MULTIPLE DISC CLUTCHES.

With many trucks that have multiple disc clutches, difficulty is sometimes experienced in changing the gears. There are many causes for noise when gear shifting, but one of the most common is the "sticking of the clutch." A multiple disc clutch is usually built of steel discs, which are alternately faced with asbestos or some anti-friction material. Grease or oil from the transmission gearset or universal joint may work out on to these plates and will cause them to stick to each other. When the clutch is engaged a large spiral spring holds these discs against each other and against the engine flywheel. When the clutch is disengaged the tension is taken off these discs by releasing the spring. The plates should disengage themselves and

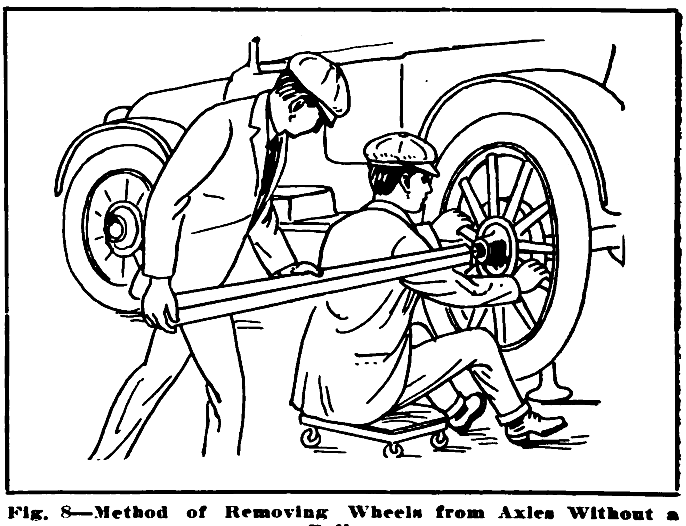

Fig. 8—Method of Removing Wheels from Axles Without a Puller.

the separation will stop the clutch shaft.

If these discs do not disengage the clutch shaft will not idle itself and will therefore make gear shift-

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ing noisy and difficult. This type of clutch is usually provided with a small hole for applying oil to these plates. When the plates are sticking a quantity of kerosene should be squirted through this hole and the clutch pedal worked back and forth. This should then be followed with a solution of equal parts of machine oil and kerosene. Do not apply the machine oil without the kerosene, as it will cause the plates to slip. The solution of machine oil and kerosene is used because the kerosene alone would cause the plates to take hold with a grabbing effect, while with oil mixed with it the plates will engage easily.

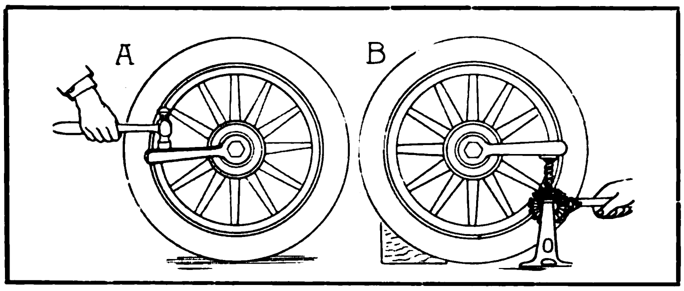

Fig. 9—A, Starting Hub Cap with Wrench and Hammer Blows; B, Using the Leverage of a Lifting Jack.

REMOVING STUBBORN HUB CAPS.

The hub cap wrenches provided with the machines usually afford ample leverage, but starting a cap is frequently difficult. Repairers employ many means to loosen stubborn caps, the most common of which is that illustrated in Fig. 9 A. While the hammer may be effective in most instances, it is not a tool favored by the thorough mechanic, except for the purposes for which it is intended. By hammering the workman not only bruises the wrench, but he may injure his hand should the hammer slip.

A simple and more effective method is shown in Fig. 9 B. If the cap should be on a rear wheel the brake can be applied which will lock the wheel, but should it be on a front wheel, a block can be forced against the tire to hold it. The wrench is then applied to the cap and the jack placed under the free end. By this method great pressure can be brought on the cap and it can generally be started. But should this fail the only recourse is to heat the cap thoroughly with a blow torch, taking care not to blister the paint. Kerosene should then be injected between the thread and the wrench applied before the cap has cooled. It is, however, preferable to blister paint than use a cold chisel that will damage, if not destroy, a hub cap.

REMOVING CARBON.

The best methods of removing carbon from the cylinders is to scrape it out or burn it by the use of oxygen. Such cleaning may be necessary when the time required for either process cannot be allowed. In such an event the carbon can be effectively removed by this process: Start the motor until it reaches a normal heat. The spark plugs should then be removed and an equal portion of a 10-cent cake of common gum camphor dropped into each cylinder. The motor should then be started and the carbon will be forced out through the exhaust. This method of cleaning is claimed to be more effective than placing denatured alcohol or kerosene in the cylinders.

GALVANIZING CAST IRON.

To galvanize cast iron the casting should first be cleaned thoroughly by immersing for a few hours in a bath of one part muriatic acid and two parts water. After removing the work it should be scrubbed with a stiff brush and fine sand and then rinsed with hot water. When the metal is perfectly clean it should be dipped in a solution of one-half pound of sal ammoniac to a gallon of water. It should then be dried quickly and placed in a zinc bath. If the surface of the metal be oily, the grease may be removed by boiling in caustic soda or lye.

When the mechanism of the differential becomes so impaired that the rear wheels cannot be turned, the car can always be towed home by removing the keys between the wheels and the driving shafts.

HANDY PRIMING DEVICE.

An engine primer that will add much to the convenience of the driver can be made by anyone who possesses average mechanical ability. A small copper tank with a shut off valve fitted in its base should be securely fastened to the front dash. A copper pipe line should then be run from the valve to the intake manifold of the cylinders. Priming can then be accomplished without raising the hood and the gasoline will be taken into the cylinders in the form of gas, whereas priming directly into the cylinder introduces only liquid, which has to be mixed with air before it will become combustible. With this equipment when one wishes to start the motor all that is necessary is to open the shut off valve and allow a sufficient quantity of gasoline to run into the manifold. This device, which is illustrated in Fig. 10, will be an effective primer for engines that are equipped with starters.

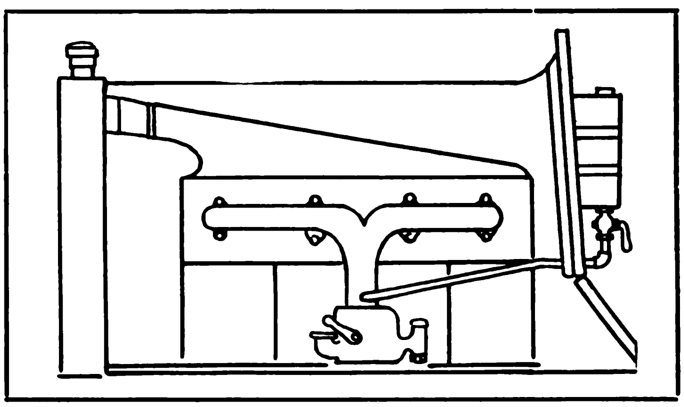
Fig. 10—Engine Priming System Designed to Supply Fuel to the Intake Manifold Above the Carburetor.

OPPOSE SIZE LIMITATION FOR TRUCKS.

An interesting analysis of the factors that enter into the matter of limiting the size of trucks that can be driven through city streets has been made by William P. Kennedy, a transportation engineer of New York. This was brought out by the proposal in New York City, Chicago and other large cities to set definite limits for truck sizes.

The reason given for the limitations is that vehicles of large size are an impediment to traffic. But at the other hand, Mr. Kennedy points out that the larger the load hauled the more economical is the movement of goods. In many classes of hauling where delays are frequent and mileage low, as along the water front and in congested districts, it is done by horses and trucks can only compete where very large loads are carried. Yet it is to the interest to everybody to get rid of horse hauling in cities for many reasons.

Among these reasons are: The reduction of the number of vehicles in the streets; lesser wear on pavements; lesser real estate occupied for stables, etc.; elimination of the often objectionable stable; elimination of unsanitary street litter from horses; quicker movement of vehicles; reduction of fire risk because of better storage and control of motor fuel than of hay and straw; reduction of dust; reduction of transportation expense.

Any limitation tending to retard the elimination of the horses therefore should be carefully considered. Such restrictions may interfere with the proper employment of large horse vehicles which must and will be used for some time to come. Certain horse trucks exceed the dimensions proposed in the ordinance at New York.

Two or more vehicles of the smaller size permitted will take up much more room than one large one carrying the same load. There may be good reasons for restrictions of size of vehicles in certain streets and localities and at certain hours of the day, but that does not justify general restrictions. All modern transportation tends toward large units in trains, steamboats and trucks.

The New York ordinance against which Mr. Kennedy's statement is directed provides for a maximum length of 24 feet six inches; height, 12 feet two inches; width, seven feet six inches.

NEW PLANT UNDER CONSTRUCTION.

Building operations on the new plant of the Beach Creek Truck and Automobile factory at Beach Creek, Penn., have been begun. The company has also secured an option on a tract of 10 acres in addition to the four which it already owns. P. J. Smith has just returned from a trip to Buffalo and Pittsburg, where he purchased the machinery necessary to build the new type of four-wheel drive truck which he has invented. He is general manager of the company.

COKE FOR GASOLINE IN TRUCKS.

Speaking before the Royal Society of Arts, Professor Vivian Lewes, a well known English authority, pointed out that for truck use there is promise of a large development of the coke burning steamer. Cars of this type are now in operation in England, he said, which equal the gasoline truck in dependability and at the current prices of the two fuels cut the cost of gasoline 50 per cent.

The design has been completed only during the past year and is the work of Thomas Clarkson. A motor 'bus in London fitted with this steam motor has been running in regular service with gasoline 'busses and has given perfect satisfaction.

A similar motor was installed in a truck and turned over to the Royal Automobile club, which ran it under its open competition rules to Brighton and back on two consecutive days, and on the basis of the results awarded the Dewar trophy for the most important achievement in automobile engineering during the year.

Fuel costs for the coke burner were shown to be about one penny, or two cents a ton-mile, while gasoline trucks of similar capacity with gasoline at 10 pennies, or 20 cents a gallon, show a ton-mile cost of approximately twice that amount.

Equal results as to fuel economy are also secured from coke burners which use lump instead of very fine material.

There is no difference between the two types of vehicle as to speed or range of operation. English buyers are very sensitive to possibilities of economy and Professor Lewes made it plain that he believed the coke burning steam truck would soon be largely used in England.

UTAH ARRANGES GOOD ROADS DAY.

Governor Spry of Utah, at the suggestion of the Rotary Club of Salt Lake City, has set aside a day for work on the roads of the state. Members of all the leading commercial organizations of the commonwealth will turn out on that day with shovels.

E. R. Morgan, state engineer, sent out a letter to all county officials urging them to get as many men onto the roads for work as possible. The work will be largely concentrated on the Lincoln highway, over which very heavy traffic to the coast is anticipated this summer.

WILL ADVERTISE PACKARD TRUCKS.

Thomas P. Phillips has become advertising manager of the truck department of the Packard Motor Car Company. He was formerly editor of a house organ for the Burroughs Adding Machine Company, and before that had been connected with the Toledo branch of the Fuller Advertising Agency.

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UNIVERSAL TRUCK ACCOUNTING SYSTEM.

Extremely Simple and Intensely Practical Record of Work and Operating Expense and Revenue, Adaptable to Any Business Having Motor Vehicle Equipment.

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THE UNIVERSAL TRUCK ACCOUNTING SYSTEM is the simplest and most practical record of motor vehicle operation ever created. While unlimited in scope and thoroughly comprehensive, it is contained in a single book of 14 pages, that covers a period of 12 months, with which is used a series of day cards, one for each day the vehicle is operated. One book and series of cards is used for each vehicle.

Office Truck No.	Make	Motor Number	Capacity	Weight	Date Purchased	Date Delivered	Chassis Cost	Body Cost	Accessory Cost	Total Cost	Tire Equipment	
											Front	Rear

Detail Record of Vehicle Investment, Printed on Second Cover of Record Book—Form 13½ Inches Width and 1¼ Inches Depth.

	Insurance				Truck Depreciation		Storage		Interest		Taxes		Est. Daily Operating Cost	Tire Guarantee Mileage Cost
	Fire	Liability	Property	Total	Annual Cost	Daily Cost	Monthly Cost	Daily Cost	Annual Cost	Daily Cost	Annual Cost	Daily Cost		
Date Effect														R. F
Date Expires														L. F
Cost														R. R
Daily Cost														L. R

Constants of Annual and Daily Cost of Fixed Charges, Printed on Second Cover of Record Book—Form 14¾ Inches Width and 1¾ Inches Depth.

This system is adaptable to any form of bookkeeping and equipment, and it can be inaugurated at any time without lessened efficiency, estimates being used for the period preceding its use. From this record the exact cost of a machine to date, both for operating and maintaining, the gross and net revenue, the value to the owner and when offered in the prevailing market, can be ascertained. Precise figures will be shown. These data could not be obtained from the average set of books by audit, while such an audit would not afford any real knowledge of the work performed and the actual service value of the machine.

So simple is the system that it can be kept by an intelligent boy or girl, and yet it is so comprehensive that with a card index the bookkeeping requirements of a business of considerable proportions can be met. Each day's record is complete in itself, and when a driver has returned his day card to the office a final statement can be prepared in a few minutes. No complication can arise and each entry is checked against another, so there is no possibility of error.

SPECIFIC OPERATING DATA.

When operating a vehicle with this system specific data is essential, and that this may be instantly available for reference a form is printed on the second cover, which includes the office number of the truck, the make, the motor number, the capacity of the vehicle, the weight of the completely equipped machine, the date purchased, the date delivered, the cost of the chassis, the body and the accessories, the total cost and the tire equipment by sizes. This affords a complete office reference for any need for any one type or size of vehicle required for any service.

The second form shows the constants of the fixed charges for operating, which are represented by daily and annual costs. The first of these is insurance, fire, liability and property, giving the dates the policies are effective, the dates they expire, the annual and daily cost of each form of insurance for the term, and the total cost of each for the day and for the period insured. At a glance one can obtain the facts to ascertain the value of the unexpired insurance at any given date.

The second constant is truck depreciation, given in

STATEMENT OF TRUCK OPERATING COSTS AND EARNINGS.			
Total Operating Cost	$2500	Total Revenue	$5000
Net Earnings	2500		
	$5000		
STATEMENT OF PRESENT VALUE OF TRUCK.			
Investment (Less Tires)	$3000	Depreciation Earned	$ 600
		Actual Cost of Truck	2400
			$3000
STATEMENT OF TIRE COST AND PRESENT VALUE.			
RF 36-5 S Guarantee 5000	$ 100	1850 Miles at 2c	$ 37
LF 36-5 S Guarantee 5000	100	1000 Miles at 2c	20
RR 36-4 D Guarantee 5000	200	1500 Miles at 4c	60
LR 36-4 D Guarantee 5000	200	3000 Miles at 4c	120
	$ 600		$ 237
		Guarantee, unearned value	363
ESTIMATED VALUE OF TRUCK (MARKET PRICE).			
Chassis	$2000	Chassis Cost	$2400
Tires	363	Tire Cost	600
	$2363		$3000
Shrinkage on Truck	637		
	$3000		
PROFIT OR LOSS ON TRUCK INVESTMENT.			
Shrinkage on Truck	$ 637	Net Earnings	$2500
Profit by Truck Use	1863		
	$2500		

Example for Finding Truck Value and Earnings and Cost, Showing Factors and Method of Obtaining a Precise Statement—Form Printed on Second Cover of Record Book.

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annual and daily costs. This is based on the working days of the year. Thus, if the gross cost of the chassis was $3000 and the depreciation 20 per cent. annually, $600 divided by the number of working days would give the daily depreciation. Storage is a monthly charge and a daily rate, because this rate might be changed during the year. Interest is computed on the investment at a stated per cent., and is divided by the number of working days to give the daily cost. Taxes are similarly apportioned. For the purposes of comparison an estimate is made of the daily operating cost. The mileage each tire is guaranteed by the manufacturer is noted.

OPERATING COST AND REVENUE.

On this cover is also printed an example for finding the operating revenue and cost of a truck for any given period with the factors that should be used, and which can be obtained by reference to any of the monthly record sheets and adding to the totals the footings of the incompleted month's entries. This form includes the operating cost and earnings, the present value of the machine, the tire cost and the present value of the tires on the vehicle, the estimated value of the machine (market price), and the profit or loss on the truck investment. This example is filled so that by taking the figures from the record a similar statement can be quickly made.

The monthly record is filled from details from the day card. The card is heavy manila stock, perforated

MOTOR TRUCK DAILY REPORT

Date 191 Machine No.

Condition of Machine
At Start
When Garaged
Weather Conditions
At Start Storm Began Storm Ended Road Conditions
Speedometer Readings: Start Finish Total Mileage
Accidents: Time Personal Property Machine

OFFICE INSTRUCTIONS TO DRIVER

Regular Route Trip Rented to Job No.
Customer Report to Address
Time Destination Deliver to Address
Time Delivered Received by Time Returned Trip Mileage
Miles Loaded Miles Light Price Collect Charge
Time Delayed Cause Driving Time

Load: Pkgs.	Bales	Bbls.	Cases	Mis.	Known Wt.	Est. Wt.

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Miles Loaded Miles Light Price Collect Charge
Time Delayed Cause Driving Time

Load: Pkgs.	Bales	Bbls.	Cases	Mis.	Known Wt.	Est. Wt.

DRIVERS' WORKING TIME

Drivers' Names	Left Garage	Returned to Garage	Hours Worked	Hours Out	Hours Overtime

Work Summary: Miles Driven Loaded Miles Driven Unloaded
Remarks

Driver or Owner Will Check Items of Supplies Delivered, Parts Furnished, Repairs or Labor of Helpers. Bills or Sales Slips Must Be Furnished of All Transactions, for Purchases of the Garage, or for Purchases Outside by Driver. When Transactions Are With the Owner's Garage the Records Must Coincide With This. Accidents Must Be Reported in Detail on Back of This Form

MOTOR TRUCK DAILY OPERATING COST

Drivers' Names	Job Nos.	Route	Hours Worked	Rate	Total	
Helpers' Names	**Job Nos.**	**Route**	**Hours Worked**	**Rate**	**Total**	
					Total	

DRIVERS' DAILY GARAGE EXPENSE

Supplies, Repairs, Etc.	Ordered at Garage		Bought on Road			Total	
Gasoline	Gals. at ¢		Gals. at ¢		→		
Current	Kw. Hrs. at ¢		Kw. Hrs. at ¢		→		
Oil	Qts. at ¢		Qts. at ¢		→		
Grease	Lbs. at ¢		Lbs. at ¢		→		
Miscellaneous							
Repairs							
					Total		

AVERAGE DAILY OVERHEAD EXPENSE

Interest	Taxes	Insurance	Storage		Total	
				→		

TIRE RECORD

RF	LF	RR	LR	Speed. Read
No. Off	No. Off	No. Off	No. Off	Speed. Read
No. On	No. On	No. On	No. On	Speed. Read

Shoe Repair Tube Cost Tube Repair New Shoe Adjustment Total

Use Manufacturers' Serial Tire Numbers. Note Number of Tire Removed and of Tire Put On, and the Speedometer Reading at Time of Change.

WITHDRAWN FROM SERVICE

Time Cause

TOTAL COST OF DAILY SERVICE

	Wages	Supplies	Repairs	Mis.	Overhead	Tires	Tubes		Total	
Day								→		
Night								→		

REVENUE FROM TRUCK SERVICE

	Depreciation	Salvage	Labor	Route Work Value	Job Work	Rental		Total	
Day							→		
Night							→		

ADJUSTMENT, REPAIRS, INSPECTION

Adjustments, Repairs, Parts or Supplies: Ordered by

Work done Work Not Done
Remarks

Inspection Ordered: Work Necessary

Daily Work Done, Operating Expense and Revenue of Vehicle, Printed on Manila Card 18 by 11 Inches, Perforated for Folding Carried in a Substantial Case 11 by 8 Inches—On the Reverse Is the Detail Accident Report.

in the centre, folded for convenience, that is placed in a substantial moisture proof carrier that thoroughly protects it. One or more cards are used daily. Each card is so arranged that it will suffice for four route trips, or for as many different services, or for job or rental work.

DETAILS OF THE DAILY OPERATING CARD.

This card is filled in the office, instructing the driver of the work what he shall do, prior to his receiving it. The driver makes all entries required in connection with work he does, the purchases he makes

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	Wages		Operating Supplies					Repairs		Daily Overhead				Mileage			Tire R.F.			Tire L.F.			Tire R.R.			Tire L.R.			Tire			Tire			Tubes		Truck Earnings	
Drivers	Drivers	Helpers	Gas	Corr	Oil	Grease	Mis.	Regular	Acc.	Int.	Tax	Ins.	Storage	Daily	Loaded	Light	No.	Daily Mileage	Repair Cost	No.	Daily Mileage	Repair Cost	No.	Daily Mileage	Repair Cost	No.	Daily Mileage	Repair Cost	No.	Daily Mileage	Repair Cost	No.	Daily Mileage	Repair Cost	Cost	Repair	Daily Cost	Total Revenue
Total																																						
Total Mos.																																						
Total Mos.																																						
Month's Daily Av.																																						
Month's Daily Av.																																						
Monthly Daily Av. to Date																																						

Monthly Record of Work, Mileage, Operating Expense and Revenue by Days, Averaged by Month and Months, Printed on Sheets 23 Inches Width and 12 Inches Length, Covering 12 Months, Bound in Substantial Cover.

or authorizes, and whatever may be necessary to insure the machine being maintained in operative condition. He is responsible for the work of his helpers and the charges made for their service. When this card is returned to the office it is filled with the constants of the record, the different items that make up the daily operating expense and the cost of tires as based on the guarantee. The earnings of the machine in stated service value or revenue received or charged are shown.

The cards are identified by the truck number and the date. The detail of the office instructions to the driver are obvious, these being either for route, trip, job or rental work, and the orders include detail of names, addresses, reporting times, loading, deliveries, with provision for entries of mileage, loaded and light, times delayed and the causes, driving time and the character and known or estimated weight of the loads. In the event of capacity loads deliveries are receipted for by the persons to whom they are delivered. For route work the number of packages is included.

The driver enters the condition of the machine at the start and when garaged, the weather conditions and the times of the beginning and cessation of storms that affect road surfaces, the odometer readings before leaving and when he has returned to the garage, and accidents and their character. On the back of the card is a detail report of accidents. The driver also enters his name, the time of leaving and returning to the garage, the time worked, the time out and the hours worked overtime, the total mileage, the mileage light and loaded, and a report on the mechanical condition of the machine at the end of the day.

The right side of the card is devoted to a statement of

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the daily operating cost and on this are entered the names of the drivers and helpers, the numbers of the jobs, the routes worked on and the total hours worked. The office fills the rate of wage of the driver and the helpers and the total cost for the service of each. The driver's daily garage expense shows the value of supplies taken from stock, cost of supplies bought at the garage or on the road, and repairs made during the day on the road or authorized at the garage. These must be vouched for by records, sales slips or bills, and any explanation or comment necessary in connection with repairs may be entered. These items are extended and a total of the expense entered.

Under the headings of "Adjustment, Repairs, Inspection," the driver enters any orders he may give, if he has authority, for work on the machine, or this work may be ordered by the office. If instructions were given for work to be done during the night, for instance, and it is neglected, entry is made on the card for the following day that the instruction has not been carried out, which is a check against any possibility of error or overcharge.

DAILY AVERAGE OF OVERLOAD EXPENSE.

Under the caption of "Daily Average Overhead Expense" items are entered from the series of constants. The record of tires shows whether or not changes were made in the equipment, and the odometer gives the daily mileage. Note is also made of shoes repaired, tube cost, tube repair, new shoes installed and adjustments made on any tire. Should tire changes be made the numbers of the shoes removed and those installed, the manufacturers' serial numbers of these, and the odometer reading at the time of change are provided for. Should the machine be withdrawn from service, this, and the cause of withdrawal, are noted. The total cost of operating the machine is entered, this including the footings of the expense for wages, supplies, repairs, miscellaneous, overhead, tires and tubes, and provision is made for two sets of entries, if, for instance, the machine is worked during the night as well as the day.

REVENUE FROM TRUCK SERVICE.

Under the head of "Revenue from Truck Service" is provision for two series of entries, these including Depreciation, Salvage, Labor, Route Work Value, Job Work and Rental. These require some explanation in that depreciation, contrary to the general custom, is considered an earning, for this reason: If the machine is charged a specific amount for depreciation in its operating cost that amount must be earned, and if earned it must be credited, either to depreciation earned and set apart as a sinking fund with which to replace the vehicle at the expiration of the period, or credited to the general fund from which a new vehicle can be bought without drawing upon capital when occasion demands. Salvage is credited with any sum realized from the sale of anything bought for and charged originally to the truck, as old tires sold for scrap, for instance. Any profit made on labor is also credited, as is the valuation of a machine for route work, this being approximately what would be the cost of this service, but without profit.

Mach. No.	Tire No.	Type	Make	Size	Maker's No.	Cost	Date Bought	Date Wheel Put On	Date Taken Off	Mileage	Guarantee	Less Than Guarantee	Repairs	Salvage	Adjustment	Est. Cost a Mile	Actual Cost a Mile	Loss on Tire	Gain on Tire	Credit Truck	Charge Truck
	Total																				
	Total																				
	Total																				
	Total																				
	Total																				
	Total																				

Tire Record Showing Complete Detail of Mileage and Operating Cost, Form 17¼ Inches Width and 10 Inches Length, Two Sheets Being Included in Each Record Book.

The tire record shows the tire number, the type, the make, the size, the maker's number, the cost, the date

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bought, the date put on, the date removed, the mileage driven, the mileage guarantee, the mileage less than or in excess of the guarantee, the cost of repairs, the salvage, the adjustment obtained, the estimated cost a mile, the actual cost a mile, the loss or gain, and the amount to be charged or credited to or against the truck at the expiration of the service of the tire.

MONTHLY SUMMARIES AND AVERAGES.

The monthly record sheets each contain a daily summary from the day card, which include the name of the driver, the wage of the driver and the helpers, cost of gasoline, electric current, oil, grease and miscellaneous expenses; cost of repairs resulting from regular service and accident; the items of daily overhead expense, including interest, insurance, taxes and storage; the total daily mileage and the miles driven loaded and light; the record of each tire, showing the number, the mileage, the repair cost, with provision for two changes, and the cost and repair of tubes; the total operating cost and the total earnings. At the expiration of the month the columns are footed, the total of the previous months is brought forward and the two are totalled. Beneath this the daily average of each footing for the month is entered, then the daily average for the preceding months, and the daily average for the entire period. With this any detail for any day, month or period, as well as the average, can be learned at a glance. Any one can operate this system that can read and write. There is no need for special study or instructions—simply fill out the blanks, the totals must be correct.

S. A. E. CRUISE ARRANGEMENTS.

Arrangements for the summer meeting and cruise of the Society of Automobile Engineers are being rapidly completed. E. H. Holton, general passenger agent of the Northern Steamship Company, operator of the Noronic and the Waubic, on which the party will be carried, has already begun making reservations of state rooms.

Members of the society are rapidly securing transportation and a large attendance at the meeting is now assured. The Noronic will leave Detroit on Monday, June 14, at 2 p. m. It will arrive at Midland, in Georgian bay, at 2 p. m. Tuesday, June 15, and on that day the members of the party will make a trip through the Thirty Thousand Islands of the bay in the small steamer Waubic, returning in time for dinner to the Noronic just before the ship reaches Parry sound.

Wednesday there will be a picnic at Point au Baril and the night will be again spent at Parry sound. Returning to Detroit the ship will arrive at dock there at 5 p. m. Thursday, June 17.

While the ship is underway the various meetings of the society will be held. Monday afternoon will be devoted to the meeting of the standards committee, Monday evening there will be a business and professional session and these will continue on Tuesday morning and evening, Wednesday evening and Thursday morning. The section meetings will be held Monday evening at 10, Tuesday evening at 10 and Wednesday evening at 10.

The arrangements enable the members to take the most picturesque and interesting trip on the great lakes in the best and newest steamer at a moderate cost.

MAKES EMPLOYEES PARTNERS.

Especially efficient employees of the Goodyear Tire and Rubber Company have been made partners in the business by a policy which has permitted them, for the last five years, to secure common stock of the company.

This policy has resulted very satisfactorily and it is now the plan to extend it. A stockholders' meeting will be held June 1 to authorize an increase in the company's common stock, as there is none now available for the proposed distribution.

In the past the company has simply set aside the stock in the employees' names, allowing the accumulating dividends to pay for it at par. The plan has been a great stimulus to loyal, energetic work by the men who got the stock, and the company's managers believe it to have been a large factor in the growth of the company from a small concern to the largest in the tire business—one that did $35,000,000 worth of business last year.

INTERNAL GEAR DRIVE ADOPTED.

Manufacturers of internal gear drive trucks are much elated over the adoption of this type of construction by the United States Postal Department, after severe tests, for trucks to carry mail for the New York City postoffice. An installation of 30 machines is to be made.

The United States government has never systematically tested trucks for its own purpose, as have the military and other authorities of Europe, and it has adopted no standard of construction as being specially adapted for the requirements of the government departments.

Standards which had been established in the different countries of Europe were disregarded at the beginning of the war because not enough trucks of those standards could be secured, and it was necessary in the emergency to accept anything.

TO REPAIR NEW YORK ROADS.

Governor Whitman of New York has signed a bill appropriating $4,100,000 for the repair and maintenance of highways in the state during the coming fiscal year. Democrats opposed the bill in both chambers of the legislature on the ground that the amount appropriated was too large. Mayor Mitchell of New York city filed a request for a hearing on the bill, but not until after it had been sent to the governor.

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S. A. E. PROGRESS IN STANDARDIZATION.

A CAMPAIGN for international standardization of tires—both solid and pneumatic—was undertaken at the Detroit meeting of the standards committee of the Society of Automobile Engineers. It was decided to concentrate on solid tires first.

Several years ago standards for solid tires in America were adopted and these have since been used by practically all tire makers and truck manufacturers. The present campaign is one to extend this standardization throughout the world, making the American product saleable everywhere and making it possible also for truck users to get new supplies anywhere with a minimum of difficulty.

Great advantages have been secured by the standardization of truck tires that has already been accomplished. Truck makers in America or owners are able to fit any American make of tires to their trucks. This would have been impossible or very troublesome if alterations in wheels or rims were necessary.

Three Sizes of Truck Tires.

The society has previously established the fundamental dimensions involved in the mounting of solid tires and it has now recommended that the sizes be reduced to only three diameters, so that a complete stock of tires may be carried everywhere. These diameters are 32, 36 and 40 inches. A clear majority of all American truck makers are already using these three sizes. It is proposed to issue educational literature on this subject and to secure as great co-operation as possible from similar bodies in Europe to bring about international standardization.

The committee also urged the adoption of standard sizes for use in plugs and bulb bases, in both the two-wire electric system and the ground return or one-wire system, which latter is now in use on a great many motor vehicles. After collecting much data on these fittings the association has prepared drawings of the parts with dimensions, which are supplied to all makers on request. These will make bulbs and plugs perfectly interchangeable in all sockets.

Puzzles of Headlight Illumination.

The adoption of standards for headlight illumination which will conform to the requirements of various cities and states has been found to be a very trying proposition for the society. These ordinances are different in almost every locality and their enforcement depends so largely on the personal equation and the inclination of the police that they may differ in different blocks of the same city.

The factors on which any solution must be based are the distance over which a device should throw its light, the maximum height from the ground of the rays thrown, the possibility of changing the degree of illumination from the seat, and the possibility that an owner may get into trouble by substituting a bulb of higher candlepower for the one furnished by the manufacturer. Gas-filled bulbs are now being introduced on the market and the final solution will take into account their use also.

The standards committee has approved proposed regulations as to name plates, and the number of cells in standard batteries to be used in electric vehicles. Two classifications of motors for use in such vehicles may be adopted. One is designed for 60 to 66-volt operation and the other for 80 to 85-volt operation. On each motor there should be a name plate setting forth the manufacturer's name and address, the type of motor, the frame size, its voltage and ampere output at specified speed. The number of cells recommended for battery equipment is 42, in the lead-acid type, and 60 in the nickel-iron-alkali type.

World-Wide Plan of Taxation.

The United States and foreign governments have been asked and have promised to co-operate with the society in formulating a method of vehicle taxation which will be adjusted to the destructive effect of the vehicle on roads. It has been found, however, that chaos prevails in the classification of vehicles, the nature of the traffic, the amount of new roads being built, the repair and maintenance of existing roads and other information on the subject.

Numerous factors enter into the problem. They must take account of the horsepower of the vehicle, total weight, weight on driving wheels, size of wheels, type of tire, gear ratio, speed of vehicle, total time in service and class of service. Yet it is felt that the formula adopted should not have more than two or three variables, else it will be too complicated to be practical. Great difficulty is found in framing a formula that, under the conditions, can meet such requirements.

The division of the committee seeking to set a standard for silent chains has decided that the first practical step to be taken is to lay out a tentative programme in detail for consideration by makers of chains here and abroad. The programme will cover those features of chain and sprocket design which would make interchangeability of chains and sprockets possible. A list of normal pitches has been drawn up. Practically all the chains used are of less than one-inch pitch and the greater part of the business is in pitches of from ½ to ⅜-inch.

Standard for Cotter Pins.

Standards for width of fan belts and pulleys have been approved by the committee. At the present time some companies are carrying as many as 250 sizes of cotter pins and a table of 41 standard sizes that will fit all requirements has been worked out and approved by the committee. This will immensely simplify the complicated conditions that surround the use of this small, but nevertheless important part.

The miscellaneous division is working out stand-

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ards for machine screws for use in cowlboard mountings, for hose and hose clamps used on engines, speedometer-drive shaft ends, clutch facings, brake linings, position of number on motor, dimensions of mechanically driven tire pumps, bolt thread tolerance and license pads.

It was decided not to specify the distance from the attaching flange to the centre of carburetors of the side outlet type on the ground that advantages gained would be counterbalanced by restrictions placed on the development of design. The iron and steel division decided to take a ballot by letter on certain proposals for changing of percentages of various alloys in the steels that have been adopted by the society as standard materials.

DIXON OFFICIALS RE-ELECTED.

Directors and officers of the Joseph Dixon Crucible Company were re-elected at the annual meeting of the stockholders, which was held at the company's office in Jersey City, N. J., April 19. The officers are: President, George T. Smith; vice president, George E. Long; treasurer, J. H. Schermerhorn; secretary, Harry Dailey; assistant treasurer and assistant secretary, Albert Norris; directors, George T. Smith, Robert E. Jennings, George E. Long, E. L. Young, William G. Bumsted, J. H. Schermerhorn and Harry Dailey.

PURITAN COMPANY BUYS SPEEDWELL.

The 61st company whose assets have been purchased by the Puritan Machine Company of Detroit, Mich., is the Speedwell Motor Car Company of Dayton, O. The machinery, patents and drawings of the company are acquired and the Puritan Company will continue to give service to the owners of Speedwell trucks.

For the present the Speedwell business will be continued in Detroit, according to A. O. Dunk, president of the Puritan Company.

PAPER ON ELECTRIC TRUCKS.

At the San Francisco convention of the National Electric Light Association, June 7 to 11, a paper on "The Electric Vehicle and the Central Station" will be presented jointly by John F. Gilchrist and A. Jackson Marshall, respectively president and executive secretary of the Electric Vehicle Association of America. W. P. Kennedy will prepare a paper to be read by Mr. Edwards, chairman of the association committee on accounting, dealing with the accounting methods of the N. E. L. A.

The Rhineland Machine Works Company, whose factory at New Britain, Conn., under the name of the Fafnir Bearing Company, is manufacturing a full output from a large stock of imported steel, now has a plant in operation in Ivry Port, Paris, France.

PACKARD PRODUCTION LARGE.

During April the Packard Motor Car Company of Detroit, Mich., shipped more vehicles than during any month in the 14 years of its existence. The total value of the product was $2,423,000. This announcement was accompanied by the statement that a new six-story building was under construction, which would add 15 per cent. to the present area of 38 acres of floor space in the plant. The enlargement will be divided through all the departments from the forge and foundry to final assembly.

At the same time the company has been increasing its working force at the rate of about 50 men a day. Since March 22 more than 1600 new men have been added. The company has adopted a new system of physical examination of all applicants by physicians and this department has been extremely busy during the past few weeks.

Indications point to the expectation on the part of the company of greatly increased business during the year.

KARDO SUIT DISMISSED.

The Kardo Company of Cleveland, O., which some time ago took over the axle patents held by the Peerless Motor Car Company, the Baker Electric Company, the American Roller Bearing Company and the Packard Motor Car Company, has lost its suit brought against Henry J. Adams, dealing as the Reo Motor Sales Company, for infringement of the patents.

Judge John H. Clark of the United States district court, who made the decision, based it on the fact that the Kardo Company had not been legally organized under the laws of Ohio and that the $10,000 capital required by statute had not been paid in.

DR. RITTMAN GETS PLANT.

A plant is to be erected by an oil company near the new testing station of the United States Bureau of Mines to develop the process recently discovered by Dr. Rittman of Washington for the extraction of benzol and toluol from crude petroleum.

It is stated that the Woodward Iron Company will build a benzol plant at Birmingham, Ala., which is expected to cost $200,000. It is to produce about 2000 gallons of benzol a day.

TRUCK LINE FOR FRUIT.

Farmers near McEwen, Tenn., have organized a motor truck transportation service by which they expect to be able to put their fruit into the Nashville market three times a week during the season this year. These farmers figure that they lost $17,000 last year by their inability to get their fruit to market when it was ripe. On the return trips from Nashville freight will be carried for McEwen merchants.

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(Continued from Page 230.)

plicable to all kinds of business, and take care not to deceive ourselves, for if we do not deceive ourselves there is no likelihood of our deceiving others. Do not let us deceive ourselves into thinking that we are selling anything but a piece of machinery adaptable to various methods of transportation, and if we are sufficiently familiar with the service conditions under which our trucks are to be operated to satisfy ourselves that they will do us credit, we have, in the vast majority of cases, gone as far with investigation and recommendations as good business principles will justify.

LOAD RATING FORMULA PRACTICAL---Thomas.

"Can Standard Load Ratings Be Devised and Approved by Truck Manufacturers?" was the subject of a paper by H. Kerr Thomas, assistant manager of the Pierce-Arrow Motor Car Company. He spoke as follows:

In order to answer the above question, it may perhaps be of interest to the meeting to learn what my own practise has been in this respect. Reports are so constantly current as to the satisfactory or unsatisfactory showing made by any given truck in competition with some other, that taking advantage of a convention of truck salesmen from the various branches of the Pierce-Arrow Motor Car Company, about a year ago, I improved the occasion to place in their hands a method of analyzing the design of a truck from the user's point of view, to enable a just criticism of its performance to be made.

Before giving you the details of this, it may be as well to state that the suitability of a truck for a certain load may be viewed from two standpoints.

First—The possibility of carrying a certain load upon a truck without causing it to break down as a whole or in parts.

Second—The proper selection, proportioning and location of the various units of the chassis to carry a definite load with a maximum of economy.

One need not say that the latter is by far the more important of the two. What is of far greater, and indeed the only real interest to the truck user, is to know when he buys a truck that the various parts of it are selected and proportioned in accordance with recognized good practise, and that he will be able to use the truck, assuming proper attention is paid to its upkeep, with certainty of real financial advantage to himself.

Taking the broadest view of the situation, he requires to transport some thousands of pounds over a road, and wants to know that he is providing himself with a motor of a suitable capacity to do this work, neither too large nor too small, and although perhaps he does not know it, it is very desirable that he should be informed as to the gear ratios of this truck so that he may be able to determine its hill climbing capacity.

The marketing of a truck physically unsuited to the load which will be placed upon it, brings such swift and certain retribution that no one would be able to pursue such a policy for any length of time. For this reason, it seems to me that it is unnecessary to attempt to specify certain strengths for various parts, let us say the frame, or the axles, because the designer has the command of so wide a range of materials that it is quite possible to adopt almost any proportions provided suitable materials be selected. The statement that a driving axle is of a certain diameter or that a frame is of a certain section, conveys no meaning unless the strength of the respective materials employed is also stated.

To attempt to control the policy of the manufacturer or designer of a truck in this respect would be undesirable and ineffective.

Dimensions Cannot Be Standardized.

I make this statement unreservedly—the standardization of detail dimensions of trucks is wrong because it is impossible. I will give you an illustration of this from the analogy of a structure with which everyone is familiar. Suppose we have to carry a roadway across a river a hundred feet wide, by means of a single span arch. We have a choice of four methods:

(a) Stone blocks with an arch perhaps six feet thick.

(b) Reinforced concrete with a composite arch three feet thick.

(c) A steel latticed girder perhaps six feet deep, but very narrow and light.

(d) Lastly, a suspension bridge with an inverted arch of only six-inch thickness, made of steel wire of exceedingly high tensile strength.

We know from actual experience that either construction would be equally satisfactory, and it will be absurd to attempt to standardize the thickness of the arch because a clever engineer by employing suitable materials could make a satisfactory arch of whatever thickness he pleases.

Now apply this analogy to say the live axles of a gear driven truck. It can be shown that if steel having an elastic limit of 80,000 pounds be used, a two-inch diameter shaft will stand without injury, a twisting moment of 125,680 inch pounds. You would be correct in saying that a truck of a certain capacity should have two-inch drive shafts. In my own practise I employ, however, for the drive shafts, a special steel having an elastic limit of 175,000 pounds to the square inch. It is, therefore, only necessary to employ a shaft of 1 9/16-inch diameter to do the same work just as well. For obvious reasons you could not go to manufacturers and specify the quality of steel they must use. Consequently, you cannot go to the user and say for a truck of such a capacity your axles must be of a certain size.

Again we know that a solid rubber tire today requires to be of such dimensions that it is not loaded beyond 2.5 to three pounds to the cubic inch of rubber. We do not know, however, that some tire maker will not produce tomorrow a rubber compound which will stand a much greater load, and to expressly state that a solid tire must contain a definite volume of rubber is to penalize the ingenuity of the maker, and consequently to arrest progress.

Such, then, are the reasons which have led me to disregard any standardization which limits either dimensions, form or material, and since basic principles require no standardization, being themselves unchangeable, it has been my endeavor to develop a rating formula on first principles which will be applicable to anything that may be ultimately put on the market.

Objections Are Forestalled.

Before describing the proposed formula, it will be as well to attempt to deal with the probable criticisms to which it is liable.

First, it may be objected that in the formula I shall submit to you, no mention has been made of the speed of the vehicle or the revolutions of the motor. As a matter of fact, both are accounted for as the gear ratio is introduced in the equation.

The value of the co-efficient of road friction varies enormously, say from 20 to 300 pounds to the ton of weight. It is, therefore, impossible to theorize as to what power is necessary to overcome this. Custom, however, has established a useful working relationship, between the weight and the horsepower. Above this proper relationship gasoline consumption becomes excessive; below it, the vehicle cannot travel through bad ground. It is, as always, a case of compromise which may at first sight seem an arbitrary one and has been arrived at through the long and certain process of experience by many manufacturers.

We can, therefore, be certain that to move a vehicle of 1000 pounds weight through a given distance, involves an expenditure of power which in practise averages a known and constant figure. This power may be expressed as work done in foot pounds, which have an equivalent value in heat units, these being supplied by the combustion of a definite quantity of gasoline. To burn this gasoline requires a motor of a certain capacity, and since all modern motors have commercially a volumetric efficiency of 60 to 65 per cent., we really are led back to the dimensions of the motor and its speed, its breathing capacity as we may term it, as the unit of measurement of its capacity, in proportion to the unit weight, moved through a unit distance. We may thus have a small motor turning over fast with a large gear reduction, or we may have a large motor revolving comparatively slowly with a small gear reduction, and the result will be the same.

It is apparent that there must be a definite relation between the size of the motor, the gear ratio and the total weight of the vehicle, and it is an easy matter to combine these between the size of the motor, the gear ratio and the total weight of the vehicle, and we can state them in a simple expression that will give us a co-efficient of correct design. It is self-evident that a motor of a certain size must be necessary to haul an automobile under average conditions, and the size of the motor can be most easily expressed, and at the same time made to include the proportions of the gear ratio, by stating its dimensions in terms of the weight moved through a certain distance.

Formula for Design Given.

Calling this co-efficient Q, we may write an equation as follows:

$$Q = \frac{\frac{\pi}{4} d^2 s n r}{D \times \frac{\pi}{12} \times W}$$

Where d is the cylinder diameter in inches;
s is the stroke;
n the number of cylinders;
r the total gear ratio;
D is the diameter of the wheel in inches;
W the gross weight of the vehicle with its load, expressed for convenience, in thousands of pounds.

This simplifies into the following equation:

$$Q = \frac{3 d^2 s n r}{D W}$$

The value of Q, therefore, is the number of cubic inches of cylinder volume per 1000 pounds moved one foot.

Before going further, it may be mentioned that for a pleasure car, Q has an average value of 30 to 35, while for a truck the figure varies from 15 to 20, in both cases the calculations being made on the highest or top gear of the vehicle. As an example, I have worked out the average value of this co-efficient Q for nine high-grade trucks of different makes and

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sizes. Bear in mind, please, that the size of the truck has nothing whatever to do with the value of Q.

First speed, 72.5 cubic inches per 1000 pounds moved one foot.
Second speed, 37.3 cubic inches per 1000 pounds moved one foot.
Third speed, 26.3 cubic inches per 1000 pounds moved one foot.
Fourth speed, 17.6 cubic inches per 1000 pounds moved one foot.

These figures are, of course, arbitrary, but it will be found that they are in accordance with good and sound practise. For specially hilly districts the first speed of a truck should have a Q value of about 80, and a top speed value of 16 to 17 for use in flat country on good roads is also good practise. The intermediate speeds must be left to the discretion of the designer, as there are reasons for certain progressions which I need not go into here and which would not interest the public.

If then, we agree that 17.5 is a correct mean value for Q for any truck on high gear, we can by substitution write another equation which will give us the value of W, which it will be remembered is in thousands of pounds gross weight of vehicle body and load, thus:

$$W = \frac{3\,d^2\,s\,n\,r}{17.5\,D}$$

and this formula is accurate.

We know, however, in practise that the driving wheels of trucks vary from 36 inches to 40 inches in diameter, and the mean of this, 38 inches, is consequently accurate within five per cent. for any truck, and it is probable that this approximates sufficiently to the requirements of the public. If therefore, we substitute this number for D in the last equation, we get

$$W = \frac{3\,d^2\,s\,n\,r}{17.5 \times 38} = .00464\,d^2\,s\,n\,r$$

But we have agreed that W is in thousands of pounds. Therefore, if W is to be expressed in pounds, the equation becomes

$$W = 4\,d^2\,s\,n\,r$$

Formula Agrees with Present Practise.

If the weight of the paying load be deducted from the gross weight, and the body weight allowances recommended by the National Automobile Chamber of Commerce be deducted from the remainder, the result is the weight of the chassis; and such a weight, it will be found, agrees with the average chassis weight adopted by the leading manufacturers of this country.

In my own practise I have found this to cover practically the whole of the rating question for trucks of whatever size and without giving any mathematical reasons, I can assure you that the numerical examples I have given you are in accordance with the practises obtaining in vehicles which are absolutely satisfactory in every way.

It would seem to me, therefore, that the formula given provides a means of rating which should be adopted and declared by every truck manufacturer in his own interests and in those of the users.

So far I have answered the first part of the question which forms the title of the paper. The second half of the question, "Whether It Can Be Approved by Manufacturers," is another; and it is perhaps not for me to answer in any case. I cannot but feel, however, that this rating is highly desirable from every point of view and I have had great pleasure in submitting the suggestion to this meeting, and shall now be glad to hear the criticisms of other manufacturers.

VALUE OF REAL MOTOR TRUCK SHOWS--Pulcher.

"We are all aware of the wonderful attendance of the shows in the past, and the general stimulus these exhibitions have been to the motor industry.

"Under the present method of handling the shows the expense is very light. Practically the entire rental for space is returned to the exhibitors, and the only expense being the railroad fare, hotel bills and salary of employees who attend the shows.

"We find that every successful industry at least once a year has a national show, at which to exhibit its wares, and buyers interested in this particular line make it a point to attend this show to get such information on the articles in which they are interested as will be to their advantage.

"Why, then, does not the motor truck industry of this United States hold a national show?

Divorce the Passenger Car Show.

"First, I believe that the truck show should be separate and entirely divorced from the passenger car show, and that the show should be held at some point centrally located in the United States also that the show should be held out of doors—under tents if you like—so that the motors may be running, the cars operating under their own power, showing their ability to do the work for which they were designed.

"The advantages of such an exhibition are many. Motor trucks are more and more being recognized as chassis on which can be placed various types of containers. In numerous lines these containers, or bodies, are actually separate machines for rapidly handling the different kinds of materials or commodities carried.

"The separating of the commercial vehicle into a power driven chassis and a power operated mechanical body has just begun. One of the greatest developments in the commercial vehicle industry will, of necessity, be the growth and development of power driven devices to be used in connection with the chassis for efficiently handling merchandise.

"Think of the attention the entire industry will receive if an out-of-door exhibit can be held, where the different chassis, with different types of bodies, with loading and unloading devices, can be shown under operation to purchasing agents, large contractors and heads of large corporations from all parts of the United States.

"If this big national show could be held in the fall, at which time the regular passenger car dealer is having a very quiet business, he will attend this show, looking for a line of trucks which will help to fill up that part of the year when the car business is a little slack.

"I believe that the dealer lacks the necessary snap and enthusiasm for the reason that he has not had the opportunity to get together with the manufacturer; he has not seen, and does not know, the possibilities of the motor truck.

"It is a fact that at any of the truck shows which have been held in the past, wherever we find a chassis operated by electricity, raising or lowering a dump body, we always find a crowd of people. The exhibit next door may be of a machine of equal capabilities, but it is not moving, and is attracting no attention.

"The question today with the manufacturer is not production, but a question of sales. I hardly believe there is a manufacturer in the business who cannot get out a greater production than he can sell. In my opinion, in order to balance production with sales, it is necessary either to get additional dealers, or more enthusiasm into the dealers you already have. A dealer, after attending a big national show, seeing the magnitude of the industry, and the possibilities of the motor truck, will go home filled with a new spirit of enthusiasm with the possibilities of the industry and will see wherein he can show a handsome profit by selling motor trucks, and that the business is a 12 months' business and not a seasonal business.

"Admission to the show should be free to all connected with the trade, a slight fee only being charged to keep out those who are merely curious. A business man's card should be sufficient for admission.

"An indoor show could be held in conjunction with the outdoor exhibition—this show to be in the nature of a picture show, if you please—in charge of some man known to be expert in certain forms of motor truck transportation, to show on this screen actual operating costs and performances, and the saving made between motor trucks and horse drawn vehicles.

"The data for use in the indoor show, I believe, can be gathered by the different companies who are members of the association, sent to a certain committee, which should be in charge of this part of the show, and tabulated in such a way that on certain days or at certain hours we could have a show and lecture covering certain types of business. This would attract a great many probable purchasers in their respective lines.

"A period of not less than six months would be required for the working out of the practical plans for such a show. Shows in the past have been of the stereotyped kind, dead and relatively uninteresting exhibitions presented in gaudy settings.

Let's Have a Business Show.

"The shows have been more or less social affairs. I believe a very strenuous effort should be made to command the attendance of large buyers; that they should be invited, invitations coming direct from our headquarters at New York City, and that the type of exhibits and problems to be discussed should be outlined in our invitations. We should tell them in a short and concise way the developments and new things we may have to show them, and I am quite sure that with the proper co-operation between the truck industry and the user we can command a very large attendance.

"We find, in practically every case where we sell a truck to a user, and sell it right, that it is an asset to him; that it is earning him money, and if we can approach all our purchasers in this same way, showing them how the purchase of a motor truck will show an earning in his business, then why is it that the motor truck industry does not advance faster than it has in the last three or four years?

"I am thoroughly convinced of the fact that we have not, up to date, presented our problems in the right way, and believe that a governing body of at least 25 truck manufacturers should get together and devise some plan whereby the motor truck industry can exhibit its product in such a way as will put the industry on a standard where it belongs."

Fire Commissioner Adamson of New York City has received bids for 12 motor driven hook and ladder trucks which are to be used in new stations in the outlying sections of the metropolis. The lowest bid was that of the International Motor Company and was $52,152. Four of the trucks are to be delivered in 90 days and four every 30 days thereafter.

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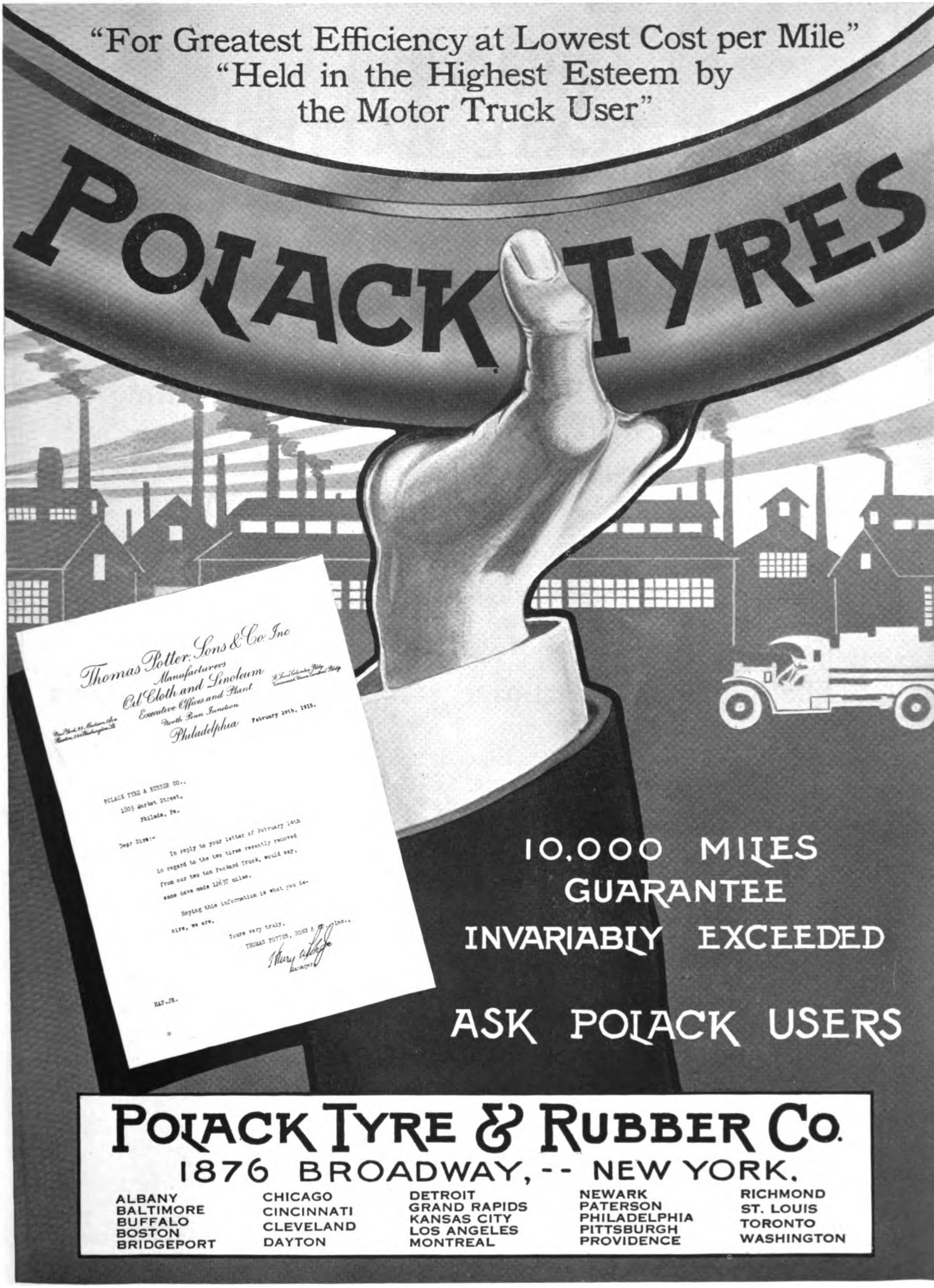

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"Diamond Grid"

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The Philadelphia Storage Battery Company, during the year 1914 increased its sales over the previous year.—Sales during the three months of this year exceed the same period of any year since the Company has been in business.

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The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

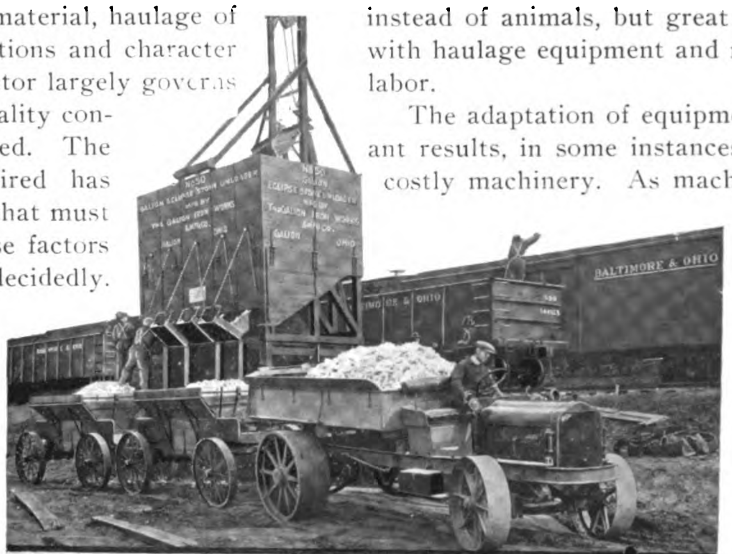
VOL. VI. PAWTUCKET, R. I., JUNE, 1915 No. 6

MOTOR TRUCK ROAD BUILDING ECONOMIES.

Practical Demonstration of the Utilities of White "Good Roads" Machines for Construction Work and Haulage, With and Without Trailers, and the Great Saving of Labor in Combination with Eclipse Portable Unloaders.

HIGHWAYS are usually constructed by contractors, the cost being based on specifications from which estimates are made, and prices for which the work will be done submitted. The work is competitive—that is, the contractor who will undertake it for the least amount is generally awarded the contract.

Six factors must govern the prices made for work—overhead expense, cost of material, haulage of material, labor, local conditions and character of equipment. The last factor largely governs the second and third. Locality conditions cannot be changed. The volume of material required has some bearing on the price that must be paid. The ratio of these factors to each other will vary decidedly.



The equipment must be that which is best adapted for the work, or for the work usually done. The manner of handling it is a matter of administration. Obviously the machinery that will minimize labor and expedite the construction is the best to use, provided that such use can be made that will justify its purchase. In this article road construction must not be confused with maintenance, for the two are entirely separate and apart.

Great Saving with Machinery.

Excavating machinery and tools have not been greatly improved other than to increase capacity and by adaptation for use in some conditions with power instead of animals, but great advance has been made with haulage equipment and machines for eliminating labor.

The adaptation of equipment has obtained important results, in some instances supplanting the use of costly machinery. As machines entail but little expense when not operating, they are extremely economical as compared with animals, which cost nearly as much when idle as when operated to capacity. Maintenance expense of equipment when not worked must necessarily enter into the cost in ratio of

Haulage and Labor Saving Equipment: At Top, Loading Trucks and Trailers at Railroad Siding with Eclipse Portable Unloader; at Left, Trucks and Trailer Train Consolidating Stone After Dumping in Road Bed; at Right, Distributing the Loads in the Excavation.

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active to inactive time. Not only this, machines can be worked to capacity constantly and continuously if necessary.

Quick Work with Good Equipment.

Some possibilities with highly developed equipment were demonstrated in a work recently completed by Louis Martine, who is building roads for which he has contracts to the amount of $90,000 in La Porte county, Indiana. He utilizes two White five-ton trucks (a type known as the "good roads" machines), and a Galion Eclipse portable unloader, the trucks for hauling and the unloader for handling material, economizing the time of the trucks and greatly reducing the labor.

The White "good roads" trucks are practically standard construction aside from the axles and wheels, for they are equipped with longer axles to take the hubs of the steel tire wheels. The bodies are steel, which are hoisted and lowered by the power of the motor, and are fitted with tail gates that can be adjusted so that the load may be discharged as the trucks are driven slowly, distributing the material to any depth and so evenly that very little levelling is necessary. With the wide tires the trucks may be driven on soft surfaces in which the ordinary rubber tired machines could not be worked. The trucks have approximately the road speed of this type, the wheel construction and steel tires making practically no difference so far as operative value is concerned.

Though built for haulage, the trucks are used for other purposes—to haul plows, scarifiers, graders and levelling drags, and the wide steel tires with the heavy load serve the same purpose as rollers when driven over the loose stone, levelling and consolidating it practically as well as the average 10-ton steam roller when driven back and forth to haul and distribute the stone. Not only this, when used with two trailers the loads can be increased to 14 tons, and with bottom-dumping trailer bodies the additional time required for the work of distributing and evening is more than compensated by the larger freight and its resultant economies.

No matter what the work, the greatest saving obtains when trucks are operated as nearly constant as possible, and while other works have been referred to, when direct haulage is done, this time economy can only be accomplished by quick loading. Mr. Martine met the requirements of his contract by purchasing a Galion Eclipse portable unloader, which is a frame mounted on axles and wheels which carries a bin that will hold approximately 15 tons of crushed stone or other material. This bin supports a frame on which is hung a block tackle. From the frame to the ground is a slightly inclined track.

Upper Left, Rolling and Evening the Stone as It Is Dumped; Upper Right, Driver Distributing the Load from the Truck; Lower Left, Truck and Trailers That Made a Mile Haul of 14 Tons of Stone and Return in 30 Minutes; Lower Right, Minimizing Labor of Levelling the Stone by Spreading from the Truck.

Labor Saving by Eclipse Unloader.

The unloader can be moved from place to place on its wheels. When located a pit is dug, into which is fitted plank sheathing. If cars are to be unloaded the end of the track to the tower frame extends to the bottom of the pit. Under the railroad track from the back of the pit is an inclined steel chute with a gate that projects into the pit. The opening to the chute is

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between two ties. The hoisting apparatus is a water cooled gasoline engine that operates a drum, a clutch connected with a long, horizontal lever that extends to the back of the pit, coupling the drum for hoisting and lowering. The material is brought to a siding in hopper-bottom cars, in which the material will concentrate by gravity, and it is dropped into and through the chute to a big steel bucket, hoisted to the top of the bin and dumped, one man attending the chute gate and the hoisting engine. On the front side of the bin are three loading chutes, and as the floor of the bin is inclined the material is carried by gravity through the chutes into the trucks or carts. Raising or lowering the outer ends of the chutes starts or stops discharge from the bins.

The unloader will handle 50 tons of stone, sand, gravel, coal, slag or similar material an hour, the only labor required other than the hoisting operator being men to move the cars as they are emptied, but if the cars are not adapted for bottom discharging, trimming the loads must be done. Trucks and carts can be loaded with five tons by gravity in approximately one minute, the drivers merely lowering and raising the chutes from the bin.

What Is Possible with Little Labor.

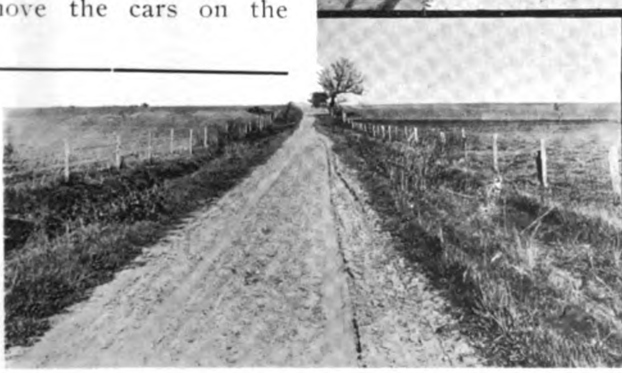
The illustrations are of construction of a mile and a half of country road between Union Mills and the Scipio township line, with the White "good roads" trucks and a Galion Eclipse unloader. This road is through a clay surface and it was built in remarkably quick time without closing it to traffic. The road was made 10 feet wide, with a 10-inch lower course of macadam and a two-inch upper course of screenings. Using the two White trucks to haul the tools, the road was excavated, widened and levelled in a single day, and when the subgrade was made the wide tires of the trucks rolled it smooth and even and sufficiently consolidated it.

The crushed stone was received in cars at a railroad siding a half mile from where the road building was begun. There the unloader was set up. A man and a team of horses were hired to move the cars on the track, and three men were employed to handle and trim the stone for the unloader. For the work on the road a foreman, two rakers and a man with a team drawn leveller were necessary. This was the entire force of men on the work. Beginning at the road nearest the unloader the White trucks hauled and spread five cubic yards of stone each trip, the machines being driven over the stone to the excavation, where the loads were distributed by the drivers opening the tail gates to the point where sufficient discharge was obtained without leaving their seats. The work was continued in this manner, driving the trucks over the stone, so consolidating it that no other rolling was necessary before laying the top dressing of screenings. The second day a half mile of the road was built in this manner in 11 hours.

Two Trucks Equal 72 Horses.

The work was continued the third day with two three-yard capacity trailers hauled by one of the trucks, and with these the loading time was extended to two minutes. The minimum haul was then one mile, one-half of this distance from the unloader to the work, through a road of alternating sand and mud, but the surface was soon compacted and hardened by the wide truck wheels. In this work a truck hauled the trailers with a 14-ton load one mile, spread the load it carried and hauled the trailers into position for dumping, and returned to the unloader in 30 minutes. Mr. Martine said that a team of two horses would haul a cart with 1¼ yards of stone in the same conditions and make a trip once an hour. With this as a basis of comparison the two trucks hauled (one with the trailers), dumped, spread and rolled stone that would have required 36 teams of horses and carts, 36 drivers to haul, to say nothing of spreading, levelling and rolling that would have been necessary. Not only this, with such a number of teams at work the road would have been more or less congested and there would have been delay at the unloader because of the practical impossibility of maintaining even headway.

With the combined utilies of the truck and the labor saving of the



Utility of the Trucks: At Top, Rolling the Macadam Into the Shoulder of the Road; at Left, the Farm Wagon Path Before the Improvement; at Right, the Highway After the Construction.

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unloader, the work was done with marked economy. From Mr. Martine's records, which are carefully kept, the following figures are taken, these showing the expense for wages and for fuel and oil for operating the trucks for a single day. During this time 264 yards of crushed stone were moved by the two trucks, the trailers being used only at intervals:

Team and driver to move cars at unloader	$2.32		
Three trimmers at unloader	7.42½		
Unloader operator	3.00		
Wages for unloading 264 cubic yards of stone		$12.74	
Cost of wages a yard			$0.0482
Two truck drivers at $3.50 a day	$7.00		
Gasoline for fuel	4.75		
Oil	1.12		
Wages and fuel for hauling, spreading and rolling 264 yards of stone		$12.87	
Cost a yard			$0.0487
Leveller team and driver	$2.25		
Foreman	3.00		
Two rakers at $2.50 a day	5.00		
Wages for levelling 264 yards of stone		$10.25	
Cost a yard			$0.0389
Total cost of wages and fuel for unloading, hauling, spreading, levelling, raking and rolling 264 yards		$35.86	
Cost a yard			$0.1350

WHITE 'BUSSES AT PIKE'S PEAK.

From Colorado Springs to the summit of Pike's Peak tourists will climb this summer in 'busses mounted on White truck chassis. The 'busses will be operated in competition with the old cog railway over a new highway 17 miles long, on which there are no grades exceeding 10 per cent. The altitude of the mountain top is 14,109 feet.

Only one other road on this hemisphere exceeds that altitude. That crosses the Andes mountains in Bolivia at a height of 17,000 feet, and is also the route of a White 'bus line.

The Pike's Peak service will begin July 15 and 12 12-passenger 'busses are being built for it by the White company. Three seven-passenger touring cars will also be provided. The new road is a masterpiece of mountain road building, with wide turn outs and an even grade. Round trips can be made in five hours and the 'bus schedules will include special trips at sunset, sunrise and by moonlight.

HATHAWAY GETS SALES TROPHY.

The white plaque, presented by the White company to the one of its 10 branches which shows the greatest proportionate increase in business every year, has been won, for the current year, by the White Boston branch, of which J. S. Hathaway is the head.

The result of this year's contest shows the steadily growing popularity of the White in New England. Winning the trophy is particularly gratifying to the Boston staff, as it came the year following the erection of the big White service station in the New England metropolis.

N. A. C. C. ELECTS OFFICERS.

There was a record attendance at the annual meeting of the National Automobile Chamber of Commerce, which chose new officers and directors. Three new directors were chosen for a three-year term: J. Walter Drake, president, Hupp Motor Car Company; R. E. Olds, president, Reo Motor Car Company; Carl H. Pelton, Maxwell Motor Company. Those reelected were Alvan Macauley, general manager, Packard Motor Car Company, William E. Metzger, American Electric Car Company, and C. W. Churchill, Winton Company.

The following officers were chosen by the directors: President, Charles Clifton, Pierce-Arrow Motor Car Company; vice president, Wilfred C. Leland, Cadillac Motor Car Company; second vice president (gasoline passenger division), Hugh Chalmers, Chalmers Motor Car Company; second vice president (commercial vehicle division), Windsor T. White, White Company; second vice president (electric vehicle division), H. H. Rice, Waverly company; secretary, R. D. Chapin, Hudson Motor Car Company; treasurer, George Pope, Pope Manufacturing Company; general manager, Alfred Reeves.

Seven new companies were elected to membership, two of which produce trucks: The Touraine Company, Philadelphia, Penn., and the Sternberg Company, Milwaukee, Wis.; truck makers, the L. P. C. Motor Company, Racine, Wis.; Scripps-Booth Company, Detroit, Mich.; Lexington-Howard Company, Connersville, Ind.; Pratt Motor Car Company, Elkhart, Ind.; W. A. Patterson Company, Flint, Mich.

A resolution declared that the "jitney" 'bus filled an important need in public transportation and that it should be encouraged, although proper regulation should not be opposed. Standard treads for all cars, with a view to reducing manufacturing costs, were urged. Some details of manufacturing and service are also to be standardized. A committee was authorized to draft a plan for making announcements at a definite period of the year.

GOODYEAR STOCK FOR EMPLOYEES.

An increase in the common stock of the Goodyear Tire and Rubber Company has been voted by stockholders and a resolution passed authorizing the management to continue its distribution of stock among the more efficient employees. A block of $1,700,000 of the new issue was set aside for the purpose. A quarter of a million dollars worth of the stock will be distributed at once and the rest parceled out over a period of years. The stock is held in the employee's name until the dividends pay for it at par. This secures greater interest in the affairs of the company on the part of the employee and is believed to have been a large factor in the growth of the company to its annual business of $33,000,000.

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GERMANS MAKE GASOLINE SUBSTITUTE.

Although enormous stores of gasoline were on hand in Germany at the beginning of the war, great quantities have been used and as the usual sources of supply are not open, the nation has turned to the chemists in hope of finding substitute fuel.

One product made is benzol, which is said to be of sufficiently good quality for successful use in any motor vehicle, except possibly in aeroplanes, where the necessity for high quality fuel is imperative. Benzol essence is a by-product of gas and coke making, or it is made directly from coal. It is made in such quantities that statement is made that there is not only sufficient to supply all engine equipment used in the war, but 6000 tons of it are spared a month for use in civil pursuits.

BUYS MANY TRUCKS FOR EXPORT.

H. G. Burford, head of H. G. Burford & Co., Limited, of London, England, has been in this country buying a large quantity of American trucks for export to England. As dealer and manufacturer he has been identified with the industry in England for 15 years. When the war broke out he was handling one of the best known German trucks, the Mercedes.

That supply was shut off, so he ordered 100 trucks from American makers. They did so well in commercial service in London that he has now contracted for a number that would be a year's output for a good sized factory.

"Taking Europe as a whole there are four internal gear drive trucks turned out to one of any other shaft driven type. I wanted that style of truck carefully made, of good materials, and from a factory capable of a satisfactorily large output," is Mr. Burford's statement of policy.

Mr. Burford said that while continental Europe had long shown a preference for the internal gear drive, its progress in England had been less rapid because the early trucks of that type were noisy. If there had been available in England at that time axles as well designed and made as those obtainable by the American truck manufacturers, the internal gear drive would now be an overwhelming favorite.

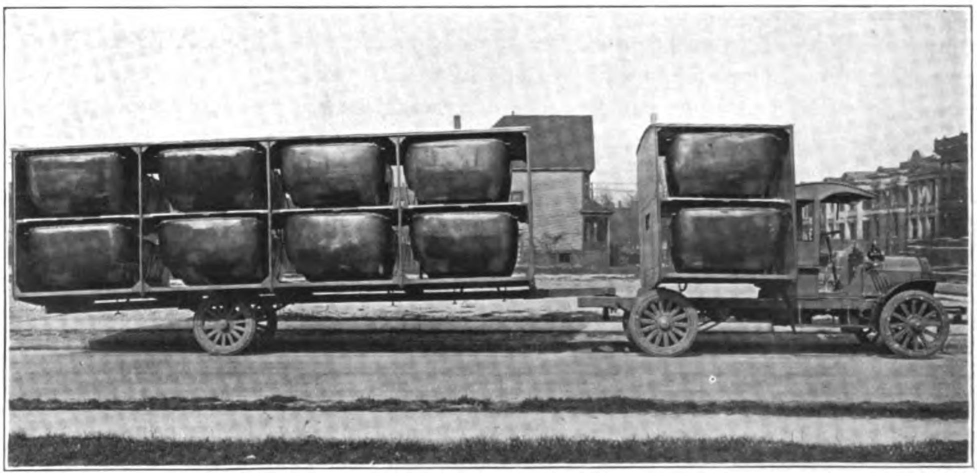
Dividend payments on its preferred stock will be resumed by the Peerless Motor Car Company, Cleveland, O., July 1, after suspension for more than a year. The company will pay quarterly dividends of 1¾ per cent. and an additional dividend of 3½ per cent. July 1.

NOVEL TRAILER SERVICE.

Unique Construction to Transport Car Bodies Between Factories.

Industrial economies are sought by progressive minds, and these are applied to meet every condition where saving of time or labor is practical. An extremely interesting example of the possibilities in transportation is afforded by the Fisher Body Company, which manufactures the bodies used for the equipment of pleasure car chassis built by the Hudson Motor Car Company at Detroit, Mich.

The plants of the two companies are nine miles apart and the Fisher company is required to deliver the bodies at the Hudson factory in sufficient numbers to meet the production requirements. When the contract was made the Fisher company used horses for haulage, and at best but two round trips could be made, this necessitating 36 miles work for the animals, which was more than horse flesh could endure. Not only was the delivery slow, but the expense was large. The weight of the loads was not excessive, but the bodies are bulky and handling was to be avoided for obvious reasons.



Wilson 3000-Pound Truck and Novel Trailer Built to Haul Bodies from the Plant of the Fisher Body Company to That of the Hudson Motor Car Company at Detroit, Mich.

To meet this exigency a large trailer was designed by G. E. Porter and built by the American Car and Foundry Company, to be used with a 3000-pound Wilson truck chassis. The trailer consists of a long frame mounted on an axle and wheels. The forward end of the trailer is designed to rest on the rear of the truck chassis and to have a transverse movement, much the same as the fifth wheel of the wagon or truck. On this frame is constructed a double-deck superstructure, which may be likened to pigeon holes, each sufficiently large to take a car body loaded transversely, with a roof covering the upper series of compartments. The design is such that while practically all of the load is carried on the trailer wheels, the forward end is supported by the truck chassis.

On the truck chassis is mounted a pair of high bol-

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sters and on this is built a double-deck superstructure with two compartments and a substantial roof and ends. None of the compartments are closed at the sides (or ends as they are viewed by the observer). The truck and its trailer can be loaded with 10 car bodies at the Fisher factory, these being secured against movement. The machine makes five round trips, or 90 miles, in a regular working day, and at times it is driven at a speed of 18 miles an hour. With this equipment 50 bodies can be delivered daily without overtime work. The saving is such that other manufacturers having large volumes of haulage are seriously considering the use of trailers for their service.

MORE TRUCK VALUE TO BE GIVEN.

Many trade authorities believe that one result of the great orders for military trucks received by American manufacturers will be to increase the truck values sold to American purchasers after the war is over.

They point out that the market for trucks previously has been so small and the reluctance of business men to buy them so great that even the large companies have conducted their business by small scale methods. The great war orders have for the first time permitted them to organize their factories for quantity production and they have turned out trucks at costs that were previously unknown.

After the war the business man will have before him the facts concerning the great efficiency of machines in the war to meet his reluctance to take up that form of transportation. Horses will be very expensive because of the large number destroyed in the fighting. The suggested new economies in truck manufacture will make possible prices that will be much more favorably regarded by the buyer than those that prevailed formerly.

In short, conditions are believed to be approaching which will greatly reduce both production and sales expense in the truck business.

NEW FIFTH AVENUE 'BUS.

The Fifth Avenue Coach Company of New York City, which operates a line of motor 'busses, has designed and built in its own shops a new type of motor 'bus body which has many advantages over the kind previously employed.

Heaters are placed under the floor instead of in the sides of the body. Push buttons are provided for each seat. A double hand rail on the rear stairway is designed for greater safety; 10 more square feet have been added to the window space and interior electric lighting facilities have been increased.

The seats are transverse with a centre aisle. Twenty-two passengers can be seated on the lower deck. The use of aluminum panels and high-grade alloy steel have reduced the weight and volume of the interior equipment.

REOS IN DAIRY TRUCKING BUSINESS.

Ira Wilson, a dairy man of Redford, Mich., has used successfully two Reo two-ton trucks to haul milk from his own and other dairy farms in the vicinity of Redford to the plant of the Detroit Creamery Company in Detroit.

The milk is carried on a rate based on 100 pounds per mile. Each truck is driven 90 miles per day. The two trucks already in operation average loads of from three to 3½ tons, although they are rated at two tons.

For two years the trucks have been in service and have never missed a trip, winter or summer, according to their owner. The road is through four miles of heavy sand. Such work, both because of the distance and the speed at which the loads must be carried, would be impossible with horses.

A third truck of the same type has been ordered. Before the trucks were used it was impossible to market all the milk in the section surrounding Redford. There was only one train a day and the trip was too long for horses.

GASO-TONIC INCREASES MILEAGE.

Reports of great increases in mileages secured from gasoline after mixing with it small quantities of a new power fluid known as Gaso-Tonic, come from Cincinnati, where the new product is made. B. W. Gaines, a physician of 409 Broadway, Cincinnati, declares that in his touring car he got 93 miles from the first 10 gallons of treated gasoline; 108 miles from the second 10 gallons; 118 miles from the third 10 gallons; 140 miles from the fourth 10 gallons, and 148 miles from the fifth 10 gallons. The fluid is said to lessen trouble from carbonized cylinders. Its makers claim that it contains no acid or other ingredient that could damage a motor in any way.

HORSELESS FIRE DEPARTMENTS.

So far as is known Lynn, Mass., was the first city in the United States to have a completely horseless fire department. The last horse used by the Lynn department was dispensed with Aug. 1, 1914.

But very soon Lynn will have a rival in Camden, N. J., which expected to retire its last horse about the last of June. Twenty-three of the 50 horses have been replaced by motors and the other 27 will be retired by the new apparatus.

Property owners of the city are enthusiastic over the aggressiveness of the city government in carrying out its policy of motorization. This campaign was inaugurated only a few months ago and has been carried through with the greatest possible dispatch. The translation of the department will cost about $140,000, but it is expected to pay for itself in a very short time, because of the smaller maintenance and operating expense of the motor equipment.

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3000 MILES CROSS-COUNTRY WITH A PACKARD.

The Finish of the Experimental Work with the Initial Three-Ton Machine a 35-Day Drive on the Lincoln Highway from Detroit to San Francisco.

TESTING an experimental truck is not a pleasure. It is a work that must be engaged in with a realization of extreme responsibility, for the endurance of the machine must be known to minute detail, for manufacturing plans and business prestige cannot be jeopardized by neglect to observe and provide for the innumerable exigencies which may arise, and which cannot be known save through careful observation.

The testing must be systematically done, and when large interests are involved, nothing can be taken for granted or accepted as an engineering determination. Failure may be expected—in fact, endeavor is made to develop causes of wear or failure, so that these may be provided for before a machine is offered for sale, so that change can be made and the vehicle perfected, but there is no reason why these conditions should not be known to the engineers who have the work to do.

Long Period of Development.

When the Packard Motor Car Company begun its engineering development of the new type worm driven machines that it is now producing a single vehicle was constructed, this being three-ton capacity, and this undertaking was without public knowledge, save perhaps in Detroit, where the truck, after it was operative, was systematically tried for months over the roads in the vicinity of that city. The development had been begun months before by the engineers, and the plans prepared according to information obtained from varying sources. After the machine had been mechanically adjusted and was regarded as practically operative, the actual trial for endurance was begun and this was continued with the factory as a base until 14,000 miles had been driven.

This would correspond to more than a year's average work, and in that period the machine was constantly under observation. But this was not sufficient. The desire was to have a trial in work that would not be on city streets and good roads, but in service that would develop any weakness. The test that would continue for a day or two was not believed to be such as would be convincing to the engineers, who wished to make large claims for the type and must have knowledge of the conditions met with on which to base these claims. The proposal was made to send the truck overland from Detroit to San Francisco, and this was approved as being a trial that would prove the real merit of the machine or cause its rejection.

The preparations were made and the crew of three selected included Consulting Engineer Russell Huff, Truck Engineer H. D. Church and "Joe" Boyer. A big bow top with canvas cover was installed on the standard ex-

Over Mountain and Desert—Top Centre, a Sand Path Between Austin and Fallon, Nev.; Upper Left, in Wyoming Desert Sand; Upper Right, Where the Crew "Mined" for the Truck; Lower Left, Climbing from Green River Valley, Wyoming; Lower Right, a Hard Hill Near Medicine Bow, Wyoming.

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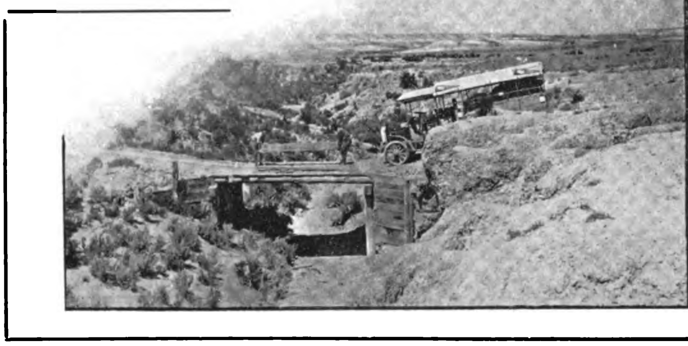
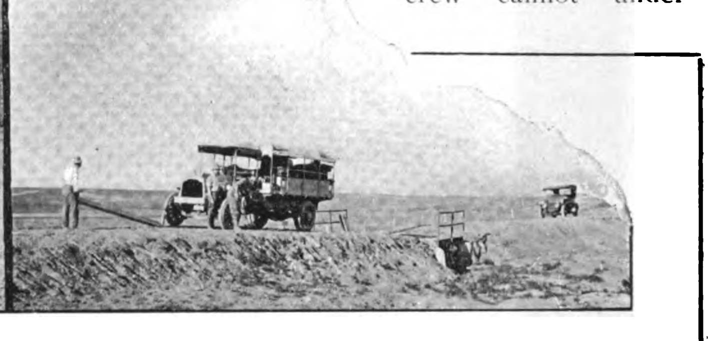
press body, this to afford protection for the men and sleeping quarters should the machine be overtaken by night outside of a town or city. The load selected included a camping outfit, canned food and cooking utensils, a generous supply of tools, including shovels, picks, axes, hatchet, hammer, saw and other implements that might be useful in the event of need; a rope and block tackle, a length of wire cable, and the personal property of the men. To this was added material to bring the weight to more than 6000 pounds. The crew was ordered to take the machine over the road to San Francisco and return, following the main roads from Detroit to Elkhart, Ind., and from that place to drive over the Lincoln highway to the Golden Gate. The truck had a sign "Detroit to San Francisco" in large letters on the canvas side curtains, which proclaimed the destination.

The start was made from the factory the morning of July 24, and while no specific date for arrival at the Pacific coast had been fixed, and no set itinerary made, the crew was expected to make as good time each day as conditions would permit. The route was the Lincoln highway from the nearest point that it could be practically reached, and while this had been traversed by tourists in pleasure cars and was known to be passable for vehicles, the drive meant a cross-country trip through conditions that would more severely try the construction than would a service period of years.

Labor Begun the First Day.

The truck and its load weighed approximately seven tons, and the machine was fitted with a 32-horsepower motor. The crew may have assumed that the journey was to be made with comparative ease, but the tourists were quickly disillusionized, for the afternoon of the first day an experience with Michigan mud in which the wheels sank nearly to the hubs gave them an impression that there would be real labor involved.

There were all kinds of experience in store for the crew, and the motorists learned precisely what had best be done in practically every condition that could be conjectured. Sinking into mud, jacking the wheels, using stone and plank blocking, filling holes with grass and brush, hauling with the tackle and cable, to say nothing of working with pick, shovel and axe in the broiling sun or drenching rain, alternated with crashing through flimsy bridges, raising the truck with levers, relaying stringers and plank, and placing a plank path ahead of the wheels to drive through sand in which the wheels revolved as in water. While these may have been anticipated to a certain extent, there was certainly little realization of the work that these mishaps entailed.

Building Bridges and Laying Plank Path: Top Centre, Part of the Bridge Held; Lower Left, Reinforcing the Deck Before Taking Chances; Lower Right, Constructing a Real Road to Save More Arduous Work.

Mudlarks and Bridge Builders.

The route was through South Bend, Ind., to Elkhart, and thence into Chicago, and from that city it was westward across Illinois by way of Joliet and Geneva to Fulton, where the Mississippi was reached, four days after the start. Crossing Iowa, the crew qualified both as mudlarks and as bridge builders, for there was a long series of smashed bridges and more mud holes were found than were ever believed existed, where the men were tried by extricating the machine and building paths and making bridges passable. If all the mud in Iowa was not on the Lincoln highway, the truck crew cannot understand how they missed it, and through Clinton, Cedar Rapids, Marshalltown, Denison and Council Bluffs the machine bucked the black gumbo and reached Omaha after crossing the Missouri river the eighth day.

This was the country of alkali water and sand and mud and frail bridges and the consequences from all, and the way was then through Kearney and North Platte, crossing Nebraska and entering Wyoming, passing Cheyenne and reaching Laramie Aug. 7. From the Missouri river the truck had been gradually climbing. But this was crossing the plains, so to speak, and ahead was the way over the mountains and the desert. The road that would maintain lighter vehicles crushed many times from the weight of the truck, and mining for the truck became a regular work instead of an unexpected happening. The dry sand rolled and yielded under the combined weight and traction thrust and any movement of the wheels would sink the machine deeper. Under a broiling sun in Wy-

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oming the crew made seven miles one day by laying plank ahead of the truck wheels and practically making a wooden path over a stretch of desert. This was seemingly the only way, and for 12 hours the men toiled to keep the machine above ground.

Two Days' Rest at Salt Lake.

Beyond Laramie the route was through Rawlins, Rock Springs and Evanston, and crossing the Utah line the truck reached Ogden and then Salt Lake City, where two days were devoted to rest. There had been hard work every inch of the way, and there was equally hard work ahead. Southwest the route led to Kearney's ranch and then west into Nevada and to Ely, Eureka, Austin, Fallon and Reno, traversing a 14-mile stretch of abandoned railroad bed after leaving Reno that is wide enough for a single machine. The custom is for motorists to rush this to avoid meeting other machines, but the truck encountered a pleasure car and while the latter passed the former, the truck broke down the side of the embankment and hung on the crest of a 60 per cent. descent. A cable attached to five telegraph poles threatened to drag them down, and so a "dead man" was buried and the truck lifted itself onto the road.

The route crossed the California line and going by way of Truckee, Sacramento and Oakland, the truck reached San Francisco at 3 o'clock the afternoon of Aug. 29, 35 days from Detroit, of which 33 were on the road. On arrival the only work necessary on the truck was a new muffler shell, a new dash and new lining for the service brake shoes. Then the crew wired the factory "Arrived San Francisco today at 3 p. m., completing the most successful transcontinental trip a truck has ever made. In perfect mechanical condition and ready and anxious to start return trip. Awaiting final instructions."

This was the report that convinced the Packard executives that the new type trucks were practically and mechanically right.

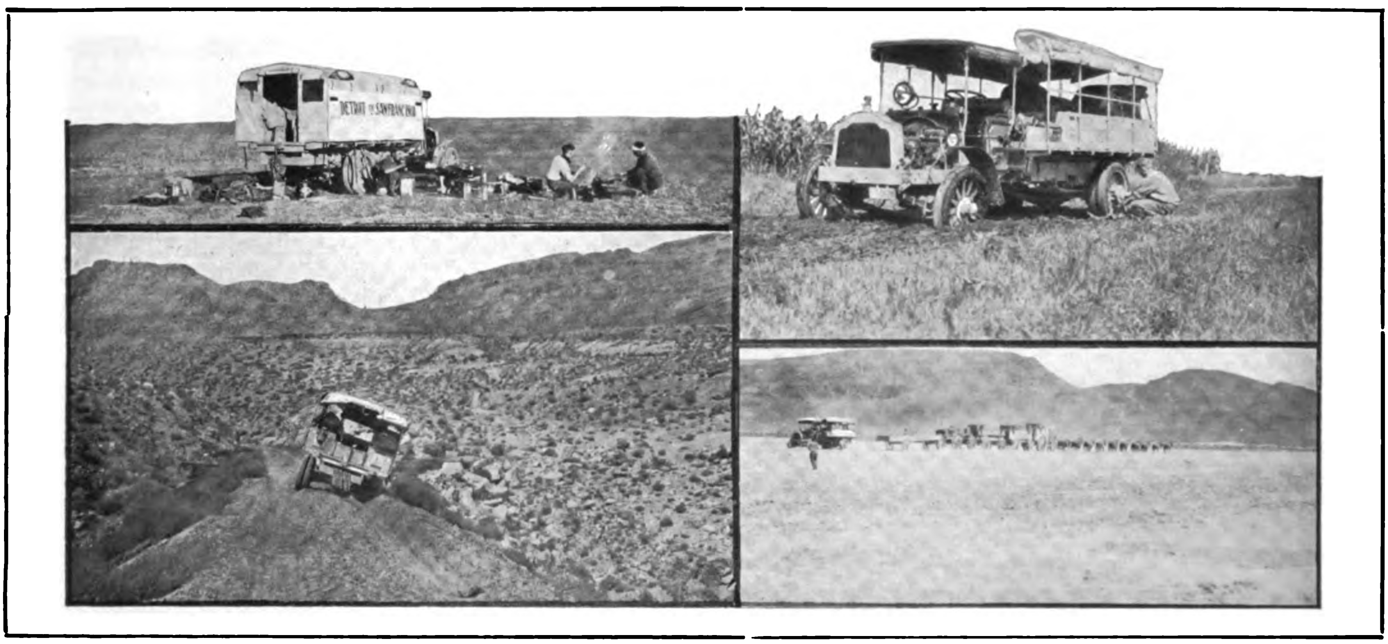
SHORTAGE OF AUTOMOBILE MATERIALS.

Inability of parts makers to secure material or to turn out parts sufficient to meet the demands of the industry is being felt particularly by new makers who find difficulty in buying any of the available supply in competition with the older companies.

This condition is acute in the truck field, owing to large orders for war trucks, and Stanley Wilson of the J. C. Wilson Company, Detroit, Mich., declares that it has made necessary the postponement of the production of his company's trucks in quantity until October. Meantime the work of fitting the plant which the company has occupied for 30 years as a carriage and body maker, is being pushed. The company will produce 1½-ton chain and worm driven trucks, designed by G. E. Porter. Some features of the truck are being redesigned.

BIG BUSINESS FOR CHASE TRUCKS.

Although it has steadily refused to accept war orders and turn its factories over to production for export, the Chase Motor Truck Company of Syracuse, N. Y., has shown a remarkable increase in volume of sales, due to its growing domestic business. At the semi-annual directors' meeting recently a report was received that the company's business for the first five months of 1915 had exceeded by 117 per cent. the amount done in any similar period in the nine years of the company's existence. This is attributed partly to the success of the company's new worm drive water cooled models and partly to its policy of developing its domestic trade exclusively.



Not Included in Regular Tests: Upper Left, at Dinner in Camp on the Plains; Upper Right, Going Through Iowa from the Top Down; Lower Left, Where the Truck and Car Met on the Abandoned Railroad Bed West of Reno; Lower Right, the Truck and the 20-Mule Team Hauling Borax in the Desert.

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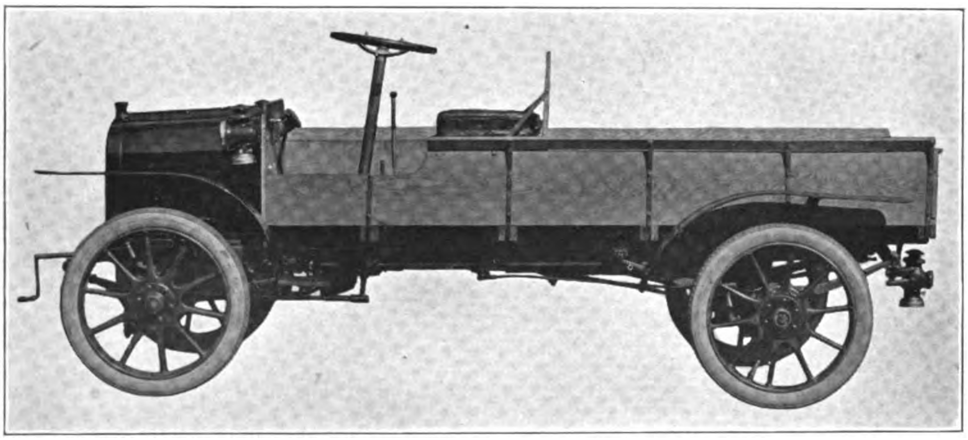
FALCON 1000-POUND TRUCK.

Company Organized to Build a Conventional Machine to Sell for $750.

The Falcon delivery wagon, which is to be produced by the Falcon Motor Truck Company, Detroit, Mich., is to be sold for $750, which is a comparatively low price for a conventional machine. While rated as stated, the manufacturer gives the capacity as 1000-1200 pounds, this being sufficient to meet the requirements of business men who have light, fast delivery, and with whom speed is a material factor.

The machine will be made in one type and size and the expectation is to standardize production. The vehicles built for experimental purposes have been found to be efficient and economical and while service rather than appearance has been the main consideration, the wagons are sightly and attractive.

The chassis is 106 inches wheelbase and 56 inches tread. The motor is a four-cylinder, four-cycle, vertical, water cooled type, that is rated at 22 horsepower by the S. A. E. formula. It is simply constructed, being cooled by a thermosyphon circulation of water through a radiator with a core set in a pressed steel shell. The engine is lubricated by a constant level splash system, the oil being drawn from a reservoir by a positive action pump and carried through a sight feed on the dash. The ignition system is the Atwater Kent, which is automatic and extremely economical. The carburetor is an automatic float feed type, which has a set adjustment and there is a hot air connection that will promote carburetion in low temperatures.



The Falcon Four-Cylinder 1000-1200-Pound Wagon, Built by the Falcon Motor Truck Company, Detroit, Mich.

The clutch is a cone type and this and the transmission gearset are assembled with the motor, giving a unit power plant. The gearset is a selective sliding gear construction, having three forward speed ratios and reverse, and drive is by shaft and bevel gear and pinion to a live rear axle. The frame is a pressed steel channel section that is mounted on semi-elliptic springs forward and rear, the rear springs being a full platform arrangement. The front axle is an I section steel drop forging, that is heat treated. The wheels are an artillery type, constructed of pressed steel, that are fitted with 30 by 3½-inch pneumatic tires. The machine is driven from the left side and the gearset shifting and the emergency brake levers are located in the centre of the footboard. The steering gear is adjustable for wear. The regular body equipment has loading space 108 inches length and 40 inches width.

The company was organized by A. B. Mallow and A. B. Hazzard of Detroit, and F. B. Houston of South Charleston, O., and Mr. Hazzard is engineer and designer of the machine. Mr. Hazzard was formerly general manager of the Norton Poole Company, Wilmington, Del., and previous to that association was a department engineer for the Rand Drill Company of New York City. For about a year he was a consulting engineer in Detroit. The plant of the company is located at 811 West Jefferson avenue.

LONG LIFE OF GEAR DRIVE TRUCK.

In compiling a history of the internal gear drive for trucks the Internal Gear Drive Association of Detroit, Mich., has discovered a truck operated by the Standard Oil Company in Indiana for between six and seven years, that covered 138,000 miles without replacement of any part of the rear axle system. It was then turned in to the maker for a new truck and on examination of the gears they were found to be in perfect condition.

More than 25 makers of motor trucks in the United States are now trying that type of axle on experimental trucks with a view to adopting it as standard. Many of these are large makers and belief is expressed that from 35 to 50 per cent. of the trucks made in the near future will have that type of drive.

A meeting of the traffic committee of the Safety First Federation, held recently in Detroit, recommended that traffic ordinances require that all chain drive trucks in use on the streets be equipped with chain guards to prevent accidents. This is regarded as a marked stimulus to the use of internal gear drive trucks.

The Boston Automobile Dealers' Association has voted to have a motor truck department for the annual exhibition that will be held at Mechanics' building, Boston, March 4-11, 1916. This will be a continuance of the policy that proved so profitable during the 1915 exhibition in March last.

The Standard Motor Truck Company, Detroit, Mich., has appointed C. C. Kriedman its superintendent of production.

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OPERATING TRUCKS FOR DEFINITE CHARGE.

Service Based on Miles Driven, Profitable to Company and Economical for Customer, a Practical Solution of Uncertainty of Motor Vehicle Maintenance.

TRANSLATION of animal drawn to motor driven transportation equipment is a serious problem with business men. While the practicality of machines and their greater speed and load capacity are understood, lack of mechanical experience and the uncertainty of expense involved deters many from changing and improving their services. Were these men to know precisely what motor wagons or trucks would cost, determination could be quickly made.

Seemingly such figures are not obtainable. Even were they obtained they could not be applied. But while the individual owner may be uncertain of himself, a specialist in motor vehicle operation can afford him a service that will be mechanically efficient and at a cost considerably less than might be possible under extremely favorable conditions.

The possibilities are amply demonstrated by the Federal Operating Corporation, which, in association with the Federal Motor Truck Company of New York, operating in New York City, is affording a service to business men at stated prices and making a reasonable profit. The company is in fullest sense a transportation operator. It does not own vehicles, but operates and maintains them at a high efficiency standard for a charge based on daily mileage.

Service at a Yearly Rate.

The customer makes contract with the company for a year's service. He buys a Federal truck and insures it against fire, personal and property liability. The company operates it for a fixed weekly price, which ranges from $42 a week upward. This means six days a week and assuming the minimum, this is $7 a day for every working day in the year, or about $2100 annually. The only additional cost to the owner is the interest on the investment, taxes, registration and depreciation. With reference to depreciation, if a fixed sum is charged against the machine for depreciation this should be credited to operating revenue, and this amount set aside as a sinking fund with which to purchase a new vehicle when the machine becomes unserviceable, or if no depreciation is charged, then replacement must be made from capital. This, however, is largely a matter of policy and bookkeeping, and is referred to here because depreciation is usually charged in operating expense and is not credited to operating revenue, so that there is a fictitious charge against the machine that is regarded as cost of operation. This statement is made to correct a prevailing assumption that depreciation charged is money actually expended, because it cannot be expended until another machine is bought, and if not expended the owner must possess the aggregate of the daily depreciation charge.

What the Service Includes.

The plan of the operating company is as follows: For the price paid it furnishes a competent driver, who is under orders from the customer; the truck is garaged, washed, polished and kept to appearance standard; gasoline, oil and grease are supplied; tires are repaired and kept operative and renewed; the truck is adjusted, inspected and repaired to maintain it efficiently operative; should the truck be inoperative from accident of any kind, a machine is supplied to replace it until the vehicle is again ready for use.

So long as the contract continues the customer has continuous, uninterrupted service. If the mileage that is the base for the contract is not exceeded the price fixed is not varied. If, for instance, there is need of additional service for one day, the extra work is charged on the basis of miles driven in excess of the base figure of the contract. Only when there is excess mileage is there added cost, and this is based on the

Federal 3000-Pound Truck Owned by a New York Vegetable Dealer and Operated for a Fixed Charge Based on Mileage.

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number of miles as shown by the odometer. To put it another way, the customer pays a stated service charge for a definite maximum mileage, and there is no reduction if this is not supplied, but if more service is at any time needed this is paid for at a specified price for each additional mile.

Customer Does Not Operate Trucks.

The customer does not take a chance with regard to operation. If his business does not justify the use of a motor truck the mistake is his, but his property is operated with care, it is well maintained, the depreciation is comparatively small, the efficiency is high, and the machine is worked under the supervision of men whose business is wholly dependent upon their ability to economize and not sacrifice. The statement is made by the company that it does not take chances, for with Federal trucks and its experience and facilities its service affords a fair margin of profit. The company has a thorough organization, which is specialized to produce operating efficiency. How the customer uses his machines is not a matter of direct concern, other than it will co-operate with him in every way so that he will obtain maximum practical results.

Another Machine in the Service of a Dealer in Ecclesiastical Books and Supplies Operated by the Same System.

The trucks are sent to the places of business of the owners at whatever time is named each morning, ready for work. The use of the trucks is dependent upon the owners, and maximum service can be consistently expected of them. After the machines are loaded the owners need give them no thought other than to provide the next loads and to have such facilities that there shall be the least time lost in loading. In the event of accident or failure the owner need have no worry or trouble. The driver communicates direct with the operating company, and whatever is necessary is done, a relief truck being sent if conditions necessitate, or repair is made or instructions are given. The work of the machine is up to the operating company.

After the driver has finished work for the day he drives to the company's station in 52nd street, where he makes report as to the condition of the truck. It is washed, cleaned, adjusted, the fuel, water and oil tanks are replenished, the oil and grease cups filled, it is adjusted or repaired, the tires are examined and the condition of the machine is carefully noted. The driver is held responsible for the operation of the truck, and while good driving is commended, any abuse or misuse is known. The machine is not neglected. It is not driven when it should be in the shop for attention, and it is frequently inspected to insure against abnormal wear. In other words, the truck is maintained to a high operating standard by an efficient organization, for the company's profits depend upon its economies.

The owner gives no thought to maintenance. Were he to provide a garage and the same organization, system and facilities, his operating cost would be large. He has no garage rental, no expense for overhead, for a machine shop, for wages, for supplies or parts, and he has no lost time of machines. He does not depart from standardized equipment. He has no driver problems. He does not have to worry concerning deliveries, and if he is using horses he can dispose of his animals and vehicles and abandon his stable. The man owning one truck can have just the same economy as the man who owns a number, and this means minimized expense for the owner who has limited requirements.

There is another aspect. The owner can figure to a penny what delivery for a route or a service will cost, and he can compute the expense of extension of business. At the end of each week he knows what any one or number of deliveries cost. There is no uncertainty. He can plan his service to meet any demand and he can please his trade and develop his business through satisfying his patrons.

The company is now operating a number of trucks with this system and the results are extremely satisfying. The machines are exceptionally well kept and promise to endure much longer than where operated in other conditions. Each contract that has been in effect for one year has been renewed for the succeeding year at slightly higher rates necessitated by the increased cost of operation.

The national convention of the National Owners' Association will take place at Springfield, Mass., June 28, at which time a considerable part of the proceedings will be given over to the consideration of the cost of operation of motor trucks and the uses of machines.

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TRACTORS FOR PATCH ASPHALT WORK.

Gasoline tractors with trailers have been applied to the work of hauling hot asphalt from the municipal plant of Manhattan borough to the streets where it is used. They take the place of horses, which had always previously been found to be cheaper.

When the plant was established a year ago it was the intention to use horses, because the many stops necessary to unload small quantities of asphalt for patch work had made the operation of conventional motor trucks more expensive in the past. Bids for horse work were found, however, to be unsatisfactory, so experiments were made with motor traction.

A four-wheel tractor with a two-wheeled semi-trailer was adopted. When the trailer arrives on the job the front end is supported on an extra set of wheels, and the tractor starts back with an empty trailer. The loaded trailer is pulled from place to place by the small street rollers until it has been emptied.

In this way the tractor is kept in practically constant motion, except for the short time required to couple to it a loaded trailer at the starting point, and to uncouple from it and hook on another empty at the destination.

Six tractors worked to this plan can do the work of 25 two-horse teams that were formerly used. The average hauls are from 7½ to 3½ miles. Twelve trailers are employed. The estimated savings as compared with horse hauling amount to about $67 a day, or $20,100 a year.

TO MAKE "RECLAIMED" TIRES.

The Double Tread Tire Company has established a factory and sales rooms at 609 North Illinois street, Indianapolis, Ind. B. E. Giffey and J. A. Gavin are financing the enterprise. Their plan is to take two discarded pneumatic tires and from the material make one new tire. A casing with a good bead and side wall is repaired and placed on the inside to contain the inner tube. Another with a fair tread is put over it. The bead is trimmed and the two are firmly stitched together. The result is a casing which the makers claim is practically blowout and puncture proof. It is said to be good for from 2500 to 10,000 miles according to the condition of the casing from which it was made.

TO SELL USED CARS ON A GUARANTY.

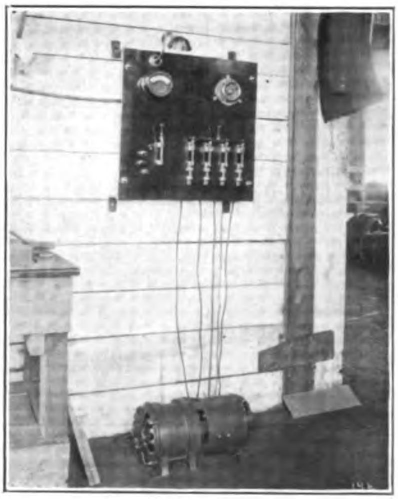
The New York Electric Vehicle Association has decided to sell a considerable number of used cars which it has on hand on a guaranty. These cars have been turned into the association by purchasers who have bought new cars. They have been thoroughly examined by the association's engineer and have been found to be in such condition as to make the guarantee practical.

LINCOLN ELECTRIC CHARGER.

New Apparatus Designed for Charging Ignition and Lighting Cells.

A complete motor generator set for charging ignition and lighting batteries is now built by the Lincoln Electric Company, Cleveland, O., which will serve a very useful purpose in a private garage or public service station. The outfit is supplied with a switchboard, such as is shown in the accompanying illustration. The motor generator is a two-bearing ball bearing machine, this construction insuring perfect alignment of the bearings.

The set consists of a single-phase motor with a shunt wound generator. The motor is not self-starting, and is started from direct current, the energy being taken from the battery, which is to be charged, the motor becoming for the purpose of starting a shunt motor. The two middle clips of the four-pole switch are higher than the two outside clips, and these middle clips are connected to the battery and are engaged first as the switch is closed.



The Lincoln Charger for Charging Ignition and Lighting Batteries.

When the switch is closed the engagement of the two middle clips throws the battery across the armature and the machine will begin to revolve. When the armature is brought up to speed the switch is fully closed and the alternating current is thrown on and the set then begins to charge the battery. The cells are charged in series, the charging voltage being varied by raising or decreasing the field voltage. The design of the set is such that it is extremely flexible and it is suited for the service of those where the number of batteries charged varies daily. The set is simple and the results are excellent.

The switchboard is about 24 inches square and is arranged for wall mounting. It carries a starting switch, voltmeter, pilot lamp and a switching device arranged to switch varying numbers of cells in series for charging. The outfit is made in two sizes, the smaller to charge any number of cells from one to eight, and the larger to charge any number from one to 15. Because of its flexibility the charger is especially adapted for the uses of garages.

Italian factories at Milan, Turin and Genoa are said to have been taken over by the government for the manufacture of motor vehicles and ammunition.

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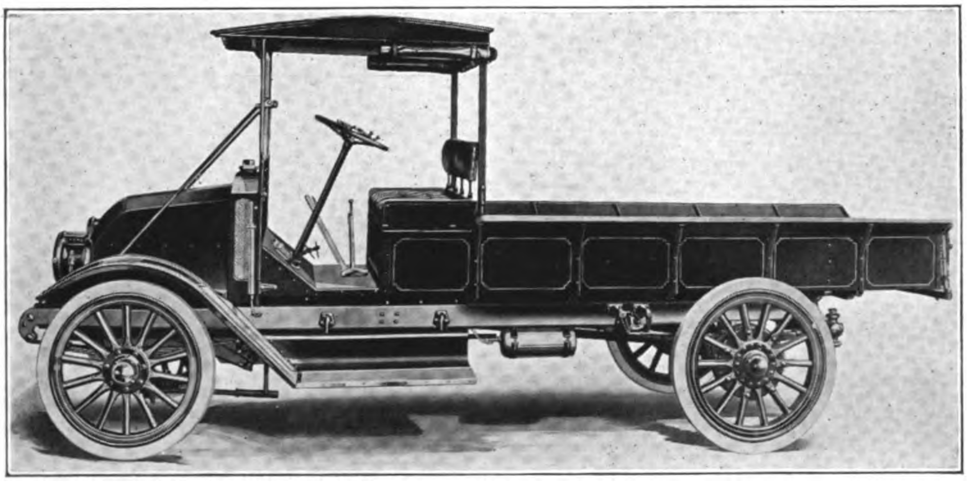
INTERNATIONAL MODEL "F" 2000 POUND TRUCK.

MODEL F is the designation of the latest and largest International truck, built by the International Harvester Company at its Akron, O., factory, which is the third type produced. The earlier machines have capacities of 1000 and 1500 pounds and have two-cylinder motors, but model F is rated for 2000 pounds and has a four-cylinder motor and it follows conventional construction.

The International Harvester Company has an international market and its own selling organization throughout the world, and its productions are based on the general requirements of the people rather than to create a demand for any specific type of machinery. Dealing in so universal a market, the design of the model F is significant. The motor is constructed with small bore and long stroke to obtain abundant power with minimum fuel consumption; the radiator is placed behind the engine in combination with the dash to thoroughly protect it in service; the drive is by shaft and internal gear, the Torbensen axle being used.



The New Model F 2000-Pound Capacity Four-Cylinder Internal Gear Driven International Truck, with Express Body and Driver's Cab.

The purpose of the designer has been to produce a machine that is extremely simple, that is accessible for inspection or work, that is thoroughly protected against abnormal wear, that is well lubricated, and which will be understood by automobile mechanics the world over. The motor, clutch and driving system gearset are mounted in a sub-frame that is carried on three points to protect them against the stresses of chassis distortion, and as the drive is through the forward ends of the rear springs there are no radius rods or torque arm.

Four-Cylinder Long Stroke Motor.

The motor is a four-cycle, water cooled, L head, vertical type, with the cylinders cast en bloc, having bore of 3½ inches and stroke of 5¼ inches, and a power rating of 19.6 horsepower by the S. A. E. formula. The maximum power production is claimed to be in excess of 25. The motor is constructed to endure in hard service. It is built with three main bearings, from front to rear they being 3¼, 2¼ and four inches length, this giving a total bearing length of 9½ inches. The crankshaft is 1¾ inches diameter and is mounted on babbitt bearings. The camshaft is large size and is carried on three phosphor bronze bearings. The connecting rod big ends have babbitt bearings, and the wristpin ends, which oscillate on hardened steel pins fixed in the piston bosses, are bushed with phosphor bronze. All the valve mechanism is enclosed by easily removable cover plates. The timing gears are helical cut to minimize wear and noise, and they drive the single camshaft, the water pump and magneto being driven by a cross shaft carried on the engine case ahead of the cylinder block.

The motor is cooled by a circulation of water through the large jackets and a vertical tube radiator located back of the motor and directly ahead of the dash from a centrifugal pump of liberal capacity, and radiation is promoted by a fan. The engine is lubricated by a force feed and splash combination system, the oil being drawn from the reservoir by a gear driven pump and forced under pressure to the main bearings and timing gears. The overflow fills troughs in the base of the crankcase, into which the big ends of the connecting rods sweep, and the camshaft bearings, cams, valve tappets, wristpins, pistons and cylinders, are lubricated by splash. The ignition is by a Bosch high-tension system, the magneto being driven by the cross shaft at the forward end of the engine. The construction is such that the water pump and the magneto are especially accessible. The carburetor is an automatic float feed type, with an adjustable hot air supply. The motor is covered by a hood of the Renault type.

The Driving System.

The clutch is a leather faced cone with springs beneath the facing to insure against harsh engagement. The power transmission gearset is a selective sliding gear type, having three forward speed ratios and reverse. The driving shaft is a large tube with universal joints at either end, and this is coupled to the pinion shaft of the Torbensen internal gear rear axle by a telescopic joint that insures against end thrust. The axle is the standard model R-I. The forward axle is a .35 carbon steel drop forged I section that is heat treated. The steering knuckles are nickel steel heat treated. The steering pivots are large, are hardened and ground, and are mounted in hardened bushings. The steering linkage is of generous proportions.

The frame is constructed of pressed steel channels

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five inches width, and has four cross members. It is strongly braced and reinforced. The frame is suspended on semi-elliptic springs, the forward set being 40 inches length and 2¼ inches width, and the rear is carried on a platform of three springs, 2½ inches width. The wheels are an artillery type, of wood, 36 inches diameter, and the forward set is shod with 36 by 3½-inch, and the rear set with 36 by four-inch, solid band tires. Pneumatic tire equipment is optional with the purchaser.

Other Chassis Details.

The service brake is external contracting and the emergency brake internal expanding, the former operating on and the latter within large drums on the rear wheels. The brake bands and shoes are faced and lined with a high-grade of brake lining. The machine is driven from the left side. The control is by the usual ignition and throttle levers on the steering wheel, by foot pedals operating the clutch and service brake, by a foot accelerator, and gear shifting and emergency brake hand levers in the centre of the footboard. The 17-gallon gasoline tank is located under the driver's seat and a gasoline gauge is on the dash.

The wheelbase is 128 inches and the tread 56 inches. The rear end of the frame overhangs the back axle 20 inches and the extreme body overhang allowed is 47½ inches. The length of the chassis overall is 173 inches, and the length, including the body, is 198 inches. The height of the platform without load is 34½ inches, and when loaded 32 inches. The open express type body with cab, such as is illustrated, has inside dimensions of 108 inches length, 44 inches width and 12 inches depth, and is fitted with flareboards six inches width. The chassis is equipped with upholstered folding, divided seats, with lazy backs. The standard equipment includes two gas head lamps, oil dash and tail lamps, Prest-O-Lite tank, horn and tools. Special equipment can include, for additional cost, electric lighting and starting system, windshield, storage battery, combined speedometer and odometer, tire chains and driver's cab, or full length top.

WILL TREBLE FAFNIR BEARING OUTPUT.

The Fafnir Bearing Company, New Britain, Conn., is about to occupy a three-story addition to its factory, 200 by 50 feet, and when this is equipped and production is begun the output of the company will be at least trebled. The company is now operating its plant 24 hours daily to fill the orders on hand. The company states that its business is excellent.

The production of the company is now marketed under the direction of Sales Manager D. D. Davis, formerly associated with the Rhineland Machine Works Company. The Rhineland Machine Works Company, which was formerly the exclusive selling agent for the sale of Fafnir bearings, is now one of the numerous distributors of these bearings. The executive offices of the company are at New Britain.

TRUCK EXPORTS EXTREMELY LARGE.

The current government fiscal year to end June 30 will greatly exceed all previous years in the volume of motor vehicle exports. In the nine months that ended with April 1 exports were 37 per cent. greater than in any previous year. While in the past trucks have been the smallest part of American automobile exports—about two per cent. of the total last year—they make up 70 per cent. this year.

Including parts the total motor exports for the nine months amounted to $32,405,826, compared with $23,-688,995 a year ago and $21,350,174 two years ago. For the nine months the exports of trucks amounted to $18,737,487, as against $861,654 last year, and passenger cars were exported to the value of $9,551,731, as compared to $17,904,002 last year.

Due to its war orders, France has become the second largest customer of the United States in motor vehicles, although before the war her buying here was negligible. French purchases for the nine months were in value $8,325,140, compared to $509,241 a year ago.

Great Britain is the largest customer, taking $8,-915,029, practically double the amount it bought last year. Germany has been cut off from commerce and we have exported only $20,164 worth of automobiles to that nation, as compared with $677,347 last year. Our shipments to Canada and South Africa have suffered as a result of the war. Mexico has bought only $59,635 worth, as compared to $241,667 in 1914 and $475,921 in 1913.

STEARNS KNIGHT ENGINED TRUCK.

Announcement has been made of a new five-ton Stearns truck, to be fitted with a Knight engine. It will be made in wheelbases of 12 and 15 feet. The former is to sell for $4500 and the latter for $4800. Stearns trucks have previously been fitted with poppet valve engines.

The drive on the new design is to be through a jackshaft and side chains. Among other features are a differential lock and a sub-frame on which the truck power plant is carried. The sleeve valve motor will have cylinders 4½ inches by 5½ inches. Front tires will be 34 by five inches and rear 38 by five, dual.

KELLY TRUCK OFFICERS AND DIRECTORS.

Directors recently elected by the stockholders of the Kelly-Springfield Motor Truck Company are Captain Marion McMillin, A. P. Lathrop, C. W. Young, E. S. Kelley, J. B. Cartmell, H. E. Freeman, C. L. Bauer, J. L. Geddes and C. N. Jellisse. The following officers were elected by the directors: President, J. L. Geddes; vice president, Captain Marion McMillin; second vice president, J. M. McCarthy; secretary and treasurer, G. W. Barden; assistant treasurer, C. N. Jellisse; assistant secretary, C. W. Young.

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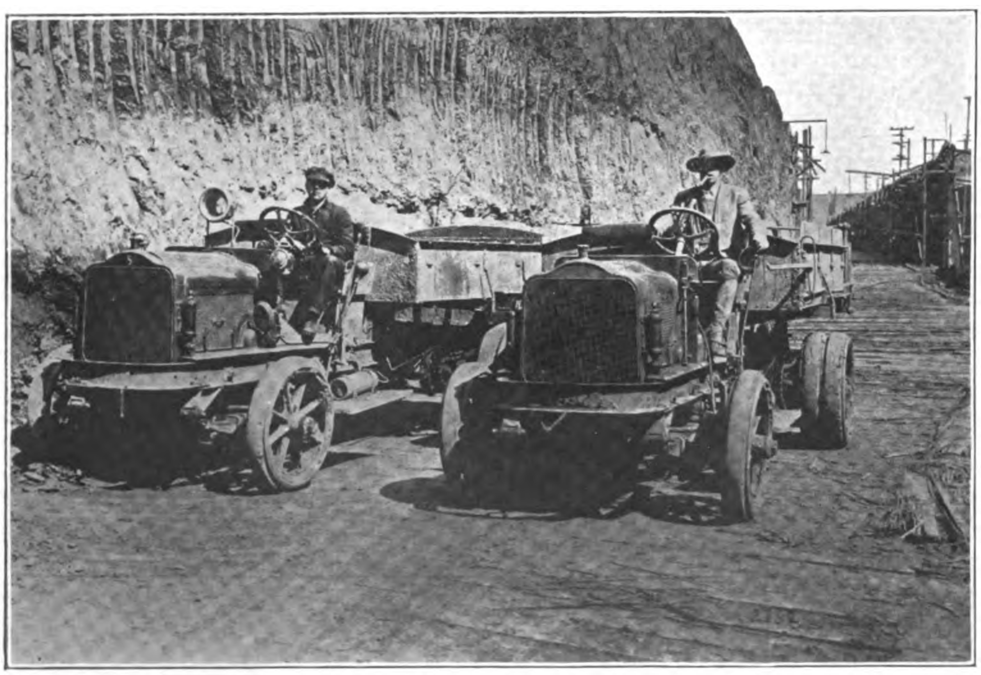
BORE TUNNEL WITH TRUCKS.

White Machines Used in Constructing Big Public Works at San Francisco.

Many thousands of visitors, as well as the residents of San Francisco, have been interested in the great public work now progressing in that city, known as the Twin Peaks tunnel. This is an engineering project of unusual proportions, and its purpose is to afford access from San Francisco through the Twin Peaks, which are elevations between the city and the level country at the south, which has many desirable residential attractions, but which has never been accessible because of the hills.

Market street, one of the main thoroughfares of San Francisco, was extended to the peaks, but there terminated because of the barrier of rugged surface on which streets could not be constructed, and the expansion of this city in this direction was regarded improbable until the roadway through the hills was conceived. The importance of the improvement was recognized and the work was begun, but with the most advanced facilities for construction. Only the progressive western spirit of the citizens of San Francisco made the work possible, and without the service of motor trucks the cost would have been prohibitive.

The tunnel, so called, is a gigantic bore for 2¼ miles through the hills, and the construction requires an arched roof 15 feet above a 30-foot roadway. The contractor for the work has a fleet of five-ton White trucks in his service, and the economical haulage of the excavated material with them will materially reduce the cost of the tunnel. These machines can be turned within the tunnel and they are quickly loaded and discharged, much of the earth and rock being used for filling where other improvements are contemplated. The accompanying illustration gives a very good view of two of the machines and shows them at a section of the work that demonstrates its magnitude.



Two of the Fleet of White Five-Ton Trucks Used in Hauling the Excavated Material from the Twin Peaks Tunnel at San Francisco, Cal.

MANY NEW WAR ORDERS RECEIVED.

In spite of the great recent production and the constant exportation of trucks to Europe for war purposes, more and more are being purchased by the European armies. The actual exportations April 1 numbered 6069 trucks, valued at $18,212,703. The Jeffrey Company of Kenosha, Wis., is said to have received from the French government an order for 1000 of its "Quads," many of which are of the new armored type developed by the company. A force of 3000 men is said to be working on the trucks and some of the departments are working 18 hours a day.

The Russian government has given the White Company of Cleveland, O., an order for 300 tank trucks, holding 1200 gallons of gasoline and 300 gallons of oil each, which will be used to haul supplies to the active motor vehicles at the front. The Peerless Motor Car Company, Cleveland, O., is reported to have received recently war orders to a total value of $6,000,000.

$200,000,000 FOR GOOD ROADS.

The total amount of state appropriations expended for road improvements in the United States reached the sum of approximately $200,000,000 at the close of the year 1914, and since the inauguration of the policy generally known as "state aid", more than 31,000 miles of surfaced highways were constructed. About 6000 miles were constructed in the year 1914. Legislatures now in session are devoting much attention to highway legislation, and it is possible that some of the seven states that are now without highway departments, namely, Georgia, Florida, Tennessee, Mississippi, South Carolina, Texas and Indiana, will soon make provisions for state departments. Georgia now grants aid to the counties for road improvement by lending the services of the entire male state convict force. The state geological survey of North Carolina now attends to the highways, but it is expected that soon the work will be taken over by an independent highway department.

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MOTOR TRUCKS HASTEN SUBWAY BUILDING.

Business and Industry Not Interrupted by Haulage of Excavated Material With Machines—Horse Carts Would Be Impossible Because of Street Congestion.

NO GREAT construction, not even the Panama canal, can compare from an engineering viewpoint, with the building of the dual subway, to increase the rapid transit facilities of New York City, now progressing on Manhattan Island. When completed this will afford two underground tubes, the one known as the Broadway and the other as the Sixth avenue, both of which will be superior to any others now in service.

Americans are accustomed to mammoth undertakings, and building subways may be so commonplace to the New York resident that no particular attention is given this work, which has been so planned that the construction does not conflict with nor interrupt business or transportation. The engineering preliminaries and the construction plans, required ample time and exceedingly careful preparation, for nothing is permitted to inconvenience the public, so that when the work was begun it was harmonized with every condition of business and industry.

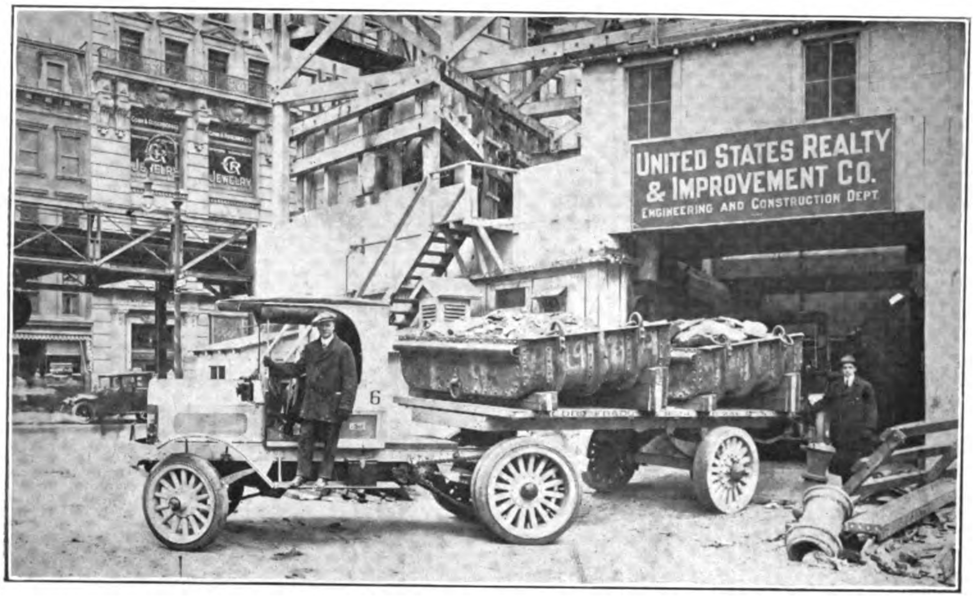
That the building can be carried on in the busiest sections of the most used streets of the chief city of America, thronged with vehicles and pedestrians, and greatly congested, is largely due to the utilization of motor vehicles for haulage, not for all classes of transportation, but of the material excavated and used for the subway construction.

The work is of such magnitude that no one contractor could undertake it, and so it is done in sections by different contractors. These sections differ in lengths and proportions. The contractors must complete them within specified periods. Each contractor must make a profit by careful organization and system and by the use of facilities that will effect the greatest economy of time and labor.

The economies possible with motor trucks is the phase with which this article has to do. It will deal with the work of the United States Realty and Improvement Company, contractor for the Broadway subway between 28th and 38th streets, a distance of approximately a half mile, which will include the big station at Herald square, between 35th and 34th streets, where Broadway crosses Sixth avenue. Here Sixth avenue, which is approximately north and south, is crossed by Broadway, which extends gradually from east to west. At this point the Sixth avenue elevated railroad tracks are overhead, the Sixth avenue and Broadway surface lines with underground trolleys have double trackage in the streets, and beneath the street surfaces are trunk sewers, telephone and telegraph cable conduits, gas and water mains, steam heating pipes and all the incidental manholes, terminal boxes, connections with the different buildings, as well as the foundations for the elevated railroad structure.

Mack 7½-Ton Chassis and Trailer with Two Stone-Laden "Skips," Near the New Broadway Subway Shaft House in Herald Square—This Load Approximates 12 Tons.

Were the subway many feet below the ground the work would be simplified, but the construction is what is known as "open work," the cutting being made from the street to the lowest grade of the subway foundation. Besides providing for the existence of underground construction during the time the excavation and the building of the tubes are in progress, wherever necessary provision must be made for supporting the buildings on either side of the streets, to prevent damage by settling. The streets were paved with asphalt laid on concrete, and when the excavating was begun the surfaces of the highways were removed to a depth of about two feet. This was done at night after the heavy traffic for the day had ceased, one side of the highways being closed to vehicular travel and an area excavated. In these areas heavy wood cross and longitudinal timbers were placed between the curb lines, and on these decks of



One of the Fradus Tractors and Trailer Hauling from the 35th Street Entrance of the Herald Square Shaft House with an Average Load of Broken Stone.

two courses of three-inch plank were securely spiked. The excavated material was removed by shovellers and horse drawn dump carts.

Work from Four Shaft Houses.

Previous to this initial work shaft houses were built at 28th, 30th, 35th and 38th streets, that at 35th street being in the square directly south of the Herald building, while the others are at the corners of the intersecting streets, covering the sidewalks and small areas of the streets, with passages for the pedestrians. From the shaft houses is taken all of the excavated material. That at Herald square is the largest and most important. The shaft houses are equipped with electrically operated derricks and bins of considerable size above the street, from which the material can be loaded into the carts by gravity.

The shafts are approximately 45 feet depth. From 28th to 30th street the work is through earth, sand and gravel, but north of the last named street, much of it is in a ledge, which must be removed by blasting. The excavating is north from 28th street, south from 38 street, and north and south from each of the other two shafts. After the deck was laid in the street from each shaft gangs dug the material from below to a depth of six feet, this being known as the "heading" work, to the full width of the cutting, shoring, bracing and supporting all of the permanent underground construction, as well as the trolley cable conduits, the railroad tracks and the deck.

Real Work Far Below the Surface.

When the material was removed and the constructions of all kinds made secure for the continuance of the work, the real excavation was begun. The shafts were extended to the full depth and then the cutting was worked out to the lower level below the "heading." But as this work progressed the excavation required the substitution of great steel girders and pillars, a literal forest of timber bracing and shoring, and all kinds of temporary work to support the underground construction that was literally left hanging in the air. The lowest grade of the subway will be much below the bottom of the big trunk sewers, and these tubes were suspended just as easily when the excavation was begun as were the small piping. Incidentally, one can conceive the complications that would have arisen had the work necessitated the interruption of any of the services or public works that had been constructed beneath the street surfaces.

One of the real problems that the contractors had to deal with was the disposal of the excavated material. The enormous volume of earth and rock to be removed to make the cutting could not be placed in the streets, because public travel and traffic could not be obstructed, and with real estate value greater than any other part of the western continent, one will assume there are no areas available, at least in the lower portion of Manhattan, where it could be deposited temporarily. The cost of removal and refilling impelled making the cutting as small as possible, and laws and ordinances required that the streets be kept clean, even to the extent of sweeping.

Disposing of the Excavated Material.

Construction companies do not own property that may be used for dumping refuse or excavated material, and each contractor was compelled to provide means for removing and disposing of the earth and rock. The United States Realty and Improvement Company sought to sell as much of this as was possible, and rented a pier at the North river, at the foot of 35th street, and fitted this with facilities for loading barges for purchasers, and also arranged to dump at the North river and Gansevoort street, and at 30th street and the North river.

Removal of the material from the subway cutting to the pier and the dumps was apparently a mere detail, but one must understand that this must be done systematically, that the haulage must continue in exact ratio to the excavating, and that delay of this meant retardation of the underground work. Haulage, however, is not specialized by the construction companies, and they have not the equipment or the experience to do this class of work economically. The United States Realty and Improvement Company made contract with Jacob Fradus for the removal of the excavated material. With approximately two years to complete its construction contract, with all probable exigencies to meet, the purpose was to take out a stated number of cubic yards of rock and earth each day, following the excavation as rapidly as possible with the permanent construction.

The surface work could only be done at night and

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in limited sections, for the street was of necessity open during the day. But small areas of the deck could be laid at a time, and not until the decking had been placed could the "heading" operations be begun. After the "heading" had been taken out the excavation to the lower grade was begun at the shafts. Fradus has been a construction contractor for a score of years, but his largest work was wrecking the ruined Equitable building following the fire that practically destroyed it. He had always used horses for his haulage, owning a few teams and carts, but hiring others when his work was in excess of his own equipment.

The subway job was a different proposition, for the construction company was to deliver the material to him at the street level and he was to haul and dump it at a rate of about 1000 cubic yards daily, but his contract required him to haul more than that if necessary. That is, he was expected to remove the material as rapidly as it was delivered to him. After considering the requirements Fradus found that at least 50 two-horse carts would be needed for normal operations, and more than that number whenever occasion demanded. To operate as many slow-moving vehicles in one of the busiest thoroughfares of America was impossible. The only solution was large capacity motor trucks. Horses could be used for the surface excavating, and teams did practically all of this haulage, but this was a very small part of the work.

Turned to Large Capacity Trucks.

Fradus made contract with the International Motor Company for four 7½-ton Mack trucks with power operated chain and pillar hoists. The first of these machines were delivered about Dec. 1. Previous to that time the greater part of the work had been in the "headings" and was comparatively slower than the main excavating, he being able to utilize horses until the trucks were in readiness. In the "headings" small industrial railroads were built for the purpose of carrying steel "skips" or shallow buckets, with capacity of about 3½ cubic yards to the shafts, where "skips" were hoisted to bins in the shaft houses, where they are dumped. This process was adopted for sand, gravel and comparatively small stone. The "skips," as may be noted from the illustrations, are strengthened with steel angles and weigh 3300 pounds each.

The excavation of soft material, which may be handled without blasting and by pick and shovel, such as was met with at 28th street, made possible the dumping of the skips, when raised to the surface, into elevated bins, from which the vehicles, standing in the street, were quickly loaded by gravity and without "trimming." The unloading by dumping with power hoists was without loss of time, but obviously there was a loss at the dump if any other form of discharge was resorted to. When the material is rock, as was found at either side of the 35th street shaft, this must be blasted and so broken that it can be handled. The larger the pieces that can be taken out the more labor is economized.

Handling the Heavy Stone.

In excavating from the shafts at the subway grade the cutting is made to width of a specified section, and to handle the material industrial railroads are built, on which are used small flat cars that are moved by the workers manually. On these the "skips" are usually loaded, but with them pieces of stone weighing up to the capacity of the vehicles to carry are taken to the shafts and hoisted by derricks operated by electricity, there being four large rings at the corners of the "skips" to take the sling hooks of the derrick falls. The stone is placed in the "skips" by hand unless the pieces are large, when chain hoists carried on the timbering are used, or with very large stone these are dragged to the cars by tackle and hoisted on them.

Work on the subway was at first continuous, but after the controversy over the employment of alien labor, which practically caused cessation of work for two weeks, it was resumed in two eight-hour shifts, the first working from 6 a. m. to 2:30 p. m., and the second from 2:30 to 11 p. m., with a half hour for lunch. Each foreman in the cutting is instructed to do a specified work each day and each gang is expected to have all the excavated material removed from the cutting and the shafts before leaving, so that the succeeding gangs will be able to go on without delay. With this rule the haulage contractor must keep pace with the excavating, or so nearly to it that there will be but a few truck loads in the shaft house bins when

Mack 7½-Ton Dumping Body Trucks with Load of Stone—These Machines Average 32 Round Trips a Day, Working 16 Hours of the 24 in Two Shifts.

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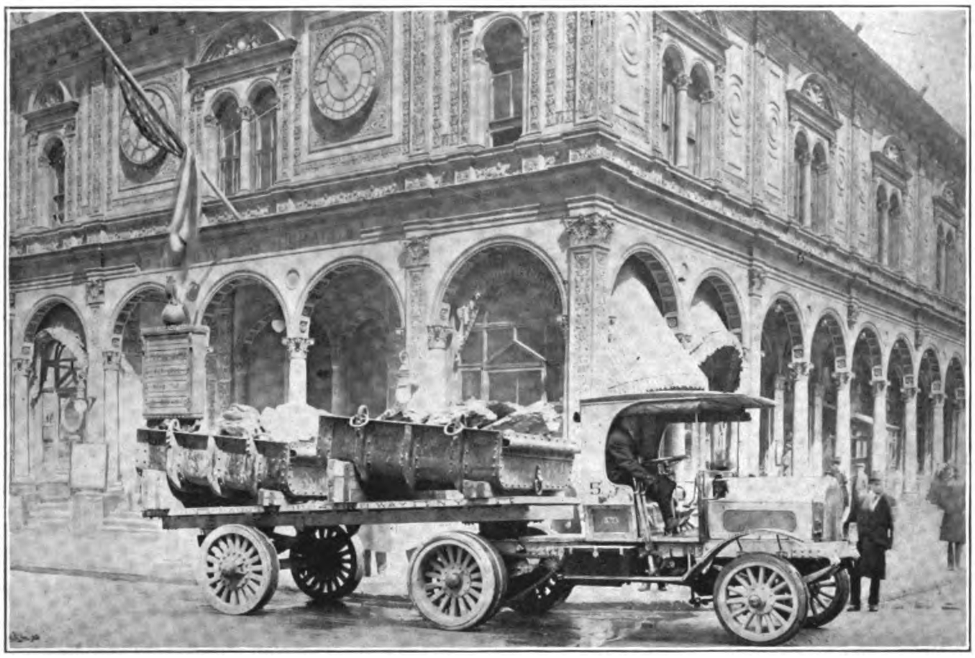
the night gangs leave, which can be hauled so that the bins will be available for the day gangs when they begin work.

Making the Trucks Earn Their Cost.

When the four 7½-ton trucks were delivered they were worked with the excavating gangs. With Fradus the problem was to do the haulage as quickly and as cheaply as possible, and with the varying needs of each day's work there was necessity of having sufficient equipment. Each truck represented a considerable investment with no future after the completion of the contract, and the purpose was to make each machine pay for itself with work. The reduction of the working time for excavating one-third meant the increase of the number of workers in the cuttings and greater haulage facilities. The streets could not be congested and there was but one solution—more trucks. The material from the 38th street shaft was hauled to a dock at 43rd street and the North river, from the 35th street shaft to a pier at 35th street and the North river, from the 30th street shaft to the dump at the North river, and from the 28th street shaft to Gansevoort street and the North river. Later on the haulage from the 38th street shaft was to the 35th street pier.



This Mack Chassis and Trailer Hauls More Than Twice the Load for Two Two-Horse Carts, Makes Twice as Many Trips as Any Cart Team, and Is Worked Twice as Long.

From the 30th street shaft to the dump the distance is about 1¼ miles, and the horses make about eight trips to the working shift, or one an hour, carrying about three cubic yards to the load, but the trucks make approximately 16 trips in the same time, carrying 6½ to seven cubic yards. From the 35th street shaft, the distance being nearly two miles, the horses vary from five to six trips, and the trucks 12 or 13 hauls. To the Gansevoort street pier from the 28th street shaft the distance and the results of haulage are approximately the same as from the 30th street shaft.

When the excavating was begun in the cutting at 35th street an experience was that the stone was taken out in large pieces, which could not be handled in the bins and loaded by gravity, and so this was hoisted to a platform of the shaft house and the loaded "skips" held until they could be lifted and dumped into the trucks. This condition also influenced unloading at the pier. For the purpose of expediting handling and saving time of handling at the shaft house a derrick was rigged at the pier with a double hoisting drum, with a trip line of fixed length at the end of the boom independent of the fall. The "skips" are built with the four rings for the derrick sling hooks and a similar ring near the bottom of the closed end. The plan was to lift the "skips" on to trailers, haul them to the pier, lift them with the derrick with the trip line hooked into the end ring. When hoisted the "skips" balance, but when lowered the trip line holds the closed end, and as the open end falls the contents are discharged by gravity. This arrangement was found practical at the shaft and as two "skips" with average loads of 3½ cubic yards each will weigh not far from 12 tons, three more 7½-ton trucks were ordered with trailers with decks arranged with permanent cradles for carrying two "skips" with the open ends toward the rear, and elevated so as to retain the contents. The type is shown in the accompanying illustration.

Tried Loads of Four "Skips."

One other truck chassis was ordered with a deck with seats for a single "skip," and then four more 7½-ton dumping trucks, this bringing the total number of machines to 12. The trailers are very heavily built and have been tested with loads up to 17 tons. Effort was made to carry two tiers of "skips," but the work of securing them required so much time, and there was the danger of the upper "skips" falling, that this was given over, although very frequently a very heavy stone, too large to be carried in the "skips," is hoisted on above the regular load and hauled. As will be noted from the illustration, these "skips" are often piled high with rock.

The excavating goes on uninterruptedly below the street, no matter what the weather, the material taken out varying from 1000 to 1200 cubic yards, which will give a very good idea of the number of trips necessary. Three dump trucks and the truck that carries a single "skip" are stationed at the 38th street shaft, the three trailers and a dumping truck at Herald square, and three dumping trucks at the 30th and the 28th street shafts, two of the 14 trucks being rented of the

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International Motor Company. Besides these 12 trucks Mr. Fradus works but two two-horse teams, but he occasionally has need of hiring other teams and carts, sometimes having as many as 20 at work for a single day or a very brief interval. The excavating has been rushed and now the section of the subway with which this article deals is more than three months ahead of the time allowed by the constructing engineers, despite the requirements of the state law relating to the employment of laborers. Had not trucks and trailers been used this gain could not have been possible, for nothing is permitted to interfere with the convenience of the people, and street congestion would have greatly reduced the number of carts that could be used. This progress is a great advantage to the contractor, and a large benefit for the people.

Big Profit from the Trucks.

The comparison of work by money values is merely approximate. Two-horse teams, cart and driver can be hired for $6.50 a day. With no lost time, working 16 hours, two teams could haul from 15 to 16 loads on the shortest hauls. This would mean $13 a day for team haulage. The trucks can make twice the number of trips and haul twice the tonnage at least in the same time, this making their unit value $52 a day at least, and the operating cost is not far from $20 a day. The machines work steady and carry capacity loads, but they are not driven fast and they are not abused. Taking the value of the work of hired horses, as a comparison, the trucks are each making at least $40 a day profit for the contractor, as compared with animal haulage.

The trucks are kept now in the garage of the owner in 54th street, but until recently they were garaged at the service station of the International Motor Company at 64th street and West End avenue, but they have been maintained by a mechanic recommended by the company, and with every facility for work they have not deteriorated. In fact, no machines in service in New York are better cared for. The garage also has the resources of the International Motor Company should there be need. The machines were worked through the winter storms that on several occasions were of unusual severity, and in but one instance was there a delay of consequence, this being the blizzard that preceded Easter Sunday. The work of the day was not completed for four or five hours after the usual time by the men, but the material was all hauled and the cutting was clear when the last load was taken on. The trucks did the work, however, for the horse carts were practically loadless the greater part of the day, and for hours none of them were worked and the machines were kept on the schedule.

The accompanying illustrations were made at Herald square, where the shaft house is between the converging car tracks, close to the elevated railroad structure. This is a building of considerable proportions and there is a drive through it so that the trailers can be driven in from Sixth avenue, the "skips" lowered from the deck or hoisted from the shaft, and driven out into 35th street. There is a chute from the bin on the Sixth avenue side, where the trucks are loaded by gravity, but as only one cart can be loaded there at a time, and the drivers are not allowed to keep the carts waiting in the street, a carefully maintained schedule and reasonable headway prevents congestion.

Unless attention was directed toward the shaft houses no observer would realize the magnitude of the work, for certainly there are no indications of congestion or interference with business or traffic by the haulage of the material, and only those who have occasion to make investigation realize to what extent motor truck transportation has benefited the people of the Metropolis, now and later on. This article deals with but a single instance of the use of machines by subway contractors, and a considerable number use them. But it evidences first of all the productiveness of machines for heavy haulage, even with short hauls and in traffic greatly congested, and it demonstrates the profit made by the owner as compared with other equipment, as well as the remarkable progress of the construction through adequate facilities and good organization.

PHILADELPHIA AUTO 'BUS SERVICES.

Between Philadelphia and some of its suburbs to which trolleys have not yet been constructed, motor omnibus lines have been placed in service. The Auto Transit Company, with offices and garage in Frankford, operates a line that taps Bustleton, Somerton, Byberry, Trappe, Nashaminy Falls and Langhorne.

The 'busses used have a seating capacity of 14 passengers and can be closed tight against the weather. Seats run lengthwise of the body. The machines are operated on regular schedules from 7:30 in the morning until 7:30 at night, leaving Frankford every three hours. The fares range from 10 to 40 cents.

CATERPILLAR TRACTOR.

The Allis-Chalmers Company, nationally known makers of machinery, has entered the motor traction field to build a caterpillar tractor, the first to be produced in America. The vehicle is designed for a service that has seemingly large possibilities. It is not meant for city use, but it is intended for the heavy work engaged in by road builders, contractors, farmers and lumbermen who have occasion to haul large loads over soft ground, and where the roads are little, if any, improved.

The tractor has a chassis of standard design whose front wheels are of the farm machine type with steel ribbed tires. The rear wheels are replaced by caterpillars. These are made of wheels and rollers enclosed in continuous flexible belts having steel treads. On the inside is a track upon which the wheels run. There are four speeds forward ranging from 1½ to 10 miles an hour, and the tractor has a drawbar pull varying from a minimum of 2370 to 9000 pounds. The tractor carries a five-ton body. It is built in Milwaukee, Wis.

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PRACTICAL MOTOR TRUCK MECHANICS.

The experienced owner will always have spare front and rear springs ready for use in the event of breakage, because the cost is comparatively small and the economy is very large when replacement is necessary. Many times a spring can only be procured from a factory, and even a wired order and express shipment will mean expensive delay, for the machine will be unserviceable until the spring can be put on.

The fact that a spring is broken, and a new one cannot be immediately procured, does not mean that another machine must be hired or obtained from the agent. A temporary restoration that can be made by any blacksmith is illustrated at Fig. 11, and at small expense and in comparatively little time a truck may be made serviceable and it can be used to its capacity if operated with reasonable care. Usually the spring will break close to the centre, where the strain is heaviest. With such a failure a piece of half-inch steel

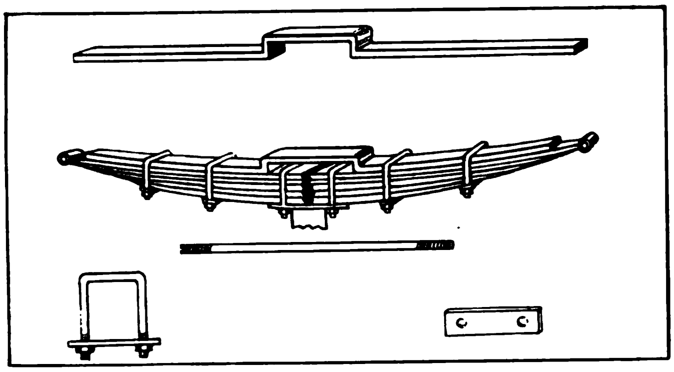

Fig. 11—Parts Used in Making a Temporary Repair of a Broken Vehicle Spring.

the width of the spring is shaped, as is shown in the sketch, and this is then placed on top of the broken spring and the whole assembled with four half-inch clips, which are threaded so that the yokes can be set up snugly. A steel plate the width of the spring and such a length as will well support it, should be drilled for the regular clips that secure the spring to the axle, and when the clips are set tight the spring ought to be strong enough to carry the normal load. When the material is good and the job is done in a workmanlike manner it will endure for a considerable length of time.

METHODS OF LOCKING NUTS.

All nuts on an automobile vehicle should be locked in some manner. The constant vibratory stresses will loosen any nut if it is not made secure. There are many means by which a nut can be locked. The cheapest and simplest method is to insert a spring washer under it as shown in Fig. 12 A. This kind of washer tends to keep a tension on the nut and prevents it turning. Another simple way is by using a second nut, as shown in Fig. 12 B. There is an important fact that should be borne in mind when using this method, and that is that the first nut should be screwed down as tightly as possible. The second nut should then be screwed on until it slightly touches the first.

Now the second nut should be held stationary

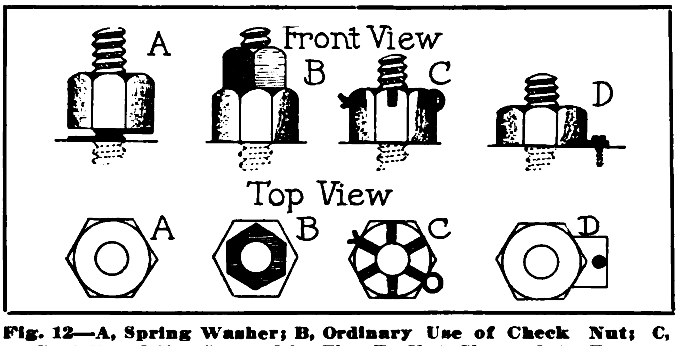

Fig. 12—A, Spring Washer; B, Ordinary Use of Check Nut; C, Castellated Nut Secured by Pin; D, Nut Clamped to Prevent Turning.

with a wrench and the first nut screwed back hard against it. If this is not done and the nuts are both screwed down tightly, the top nut will work loose and the lower one will follow. Frequently nuts have slots that are milled at right angles on the top. When this kind of nut is used the stud should be drilled so that a split pin can be inserted through the slot and hole. This is illustrated in Fig. 12 C. Still another method of securing a nut is by taking a piece of sheet metal and cutting a "V" in it. The "V" is fitted to the corner of the nut and made secure by a machine screw attaching it to the surrounding material. This method is illustrated in Fig. 12 D.

EMERGENCY CONNECTING ROD REPAIR.

Usually when a connecting rod bearing breaks or burns out, the car must be drawn home by a tow rope. Usually the lower half of the bearing breaks, as it is the part subjected to the most strain. When such a condition happens a temporary repair that will obviate towing may be made as follows: Loosen the rod from the crankshaft and scrape out the broken bearing. Then take a strip of leather and place it in the bearing bushing. If no heavy leather is obtainable, a belt can

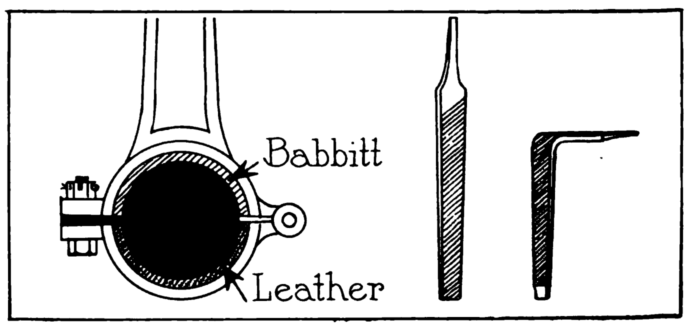

Fig. 13—Connecting Rod Babbitt Replaced by Leather Packing and Screw Driver for Heavy Work Made from Large File.

be cut and doubled and used with good results. Then screw the bearing back to the shaft, and by using a liberal supply of oil the leather will serve as a satis-

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factory substitute for the bearing for a goodly number of miles. The repair as made is shown in Fig. 13.

SCREW DRIVER FOR HEAVY WORK.

A screw driver that will be especially useful in heavy work can be made from an ordinary flat file.

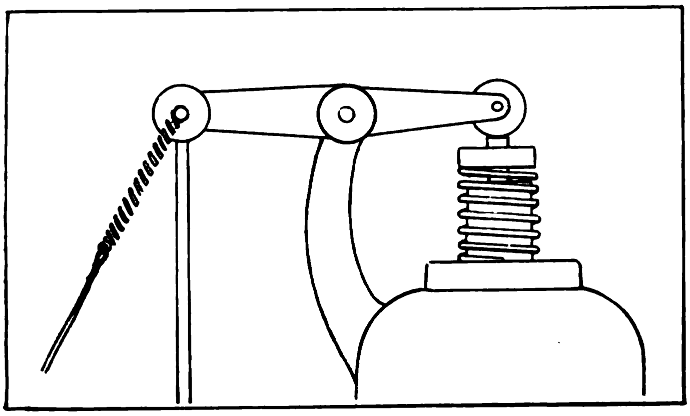

Fig. 14—Silencing Overhead Valve by Applying Tension to Rocker Arm.

The file should first be placed in a fire and heated to a red and allowed to cool. Next it should be heated in the centre and placed in a vise and bent as is shown in Fig. 13. A screw driver of this type is very useful in removing inaccessible screws and also when great pressure is needed, as a monkey wrench or piece of tubing may be used in connection with it for greater leverage.

FITTING PISTON RINGS.

The fit of the piston rings in the cylinder is very important. If not well fitted the compression will be low, the power of the explosion will be reduced, gasoline will be consumed without producing power, and the serviceability of the car greatly lessened. Carbon will accumulate on the spark plugs and cylinder heads, from the oil working by the rings and into the combustion chamber, often causing preignition and over-

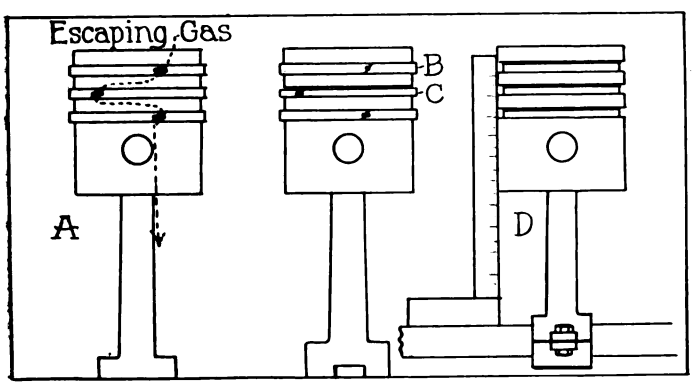

Fig. 15—A, Gas Escaping Past Wide Piston Ring Slots; B, Well Fitted Piston Ring; C, Poor Fitting Piston Ring; D, Method of Aligning Piston on Mandrel.

heating and greatly affecting engine efficiency.

Piston rings lose elasticity from wear or heating and when warped the hot gas from the explosion will pass them. Inspection of the rings will best determine if the gas is escaping. If the fit is good the ring will be polished its entire circumference, but points of leakage will be discolored. If the leakage is for a considerable part of the circumference of the ring it may be used again if a strip of thin metal is placed back of it in the channel of the piston, which will slightly increase its diameter when in the cylinder. It should be understood that the metal strip is placed only behind that section which had not contacted perfectly. If the ring has lost its elasticity, as well as fitting poorly, it had best be discarded.

When fitting a new ring it is sometimes advisable to grind it to the cylinder. The cylinder wall is coated with a mixture of machine oil and ground glass, and the piston with ring in place worked back and forth. If the ring is a good fit it will polish for the entire circumference. Care should be taken that the gap in the ring if slit is not too large, for this will allow gas to escape, as shown in Fig. 15 A. A close fit will give better results than if the ring were forced into the cylinder. The perfect fit of a ring is necessary, and if the owner is uncertain of his judgment he should seek the

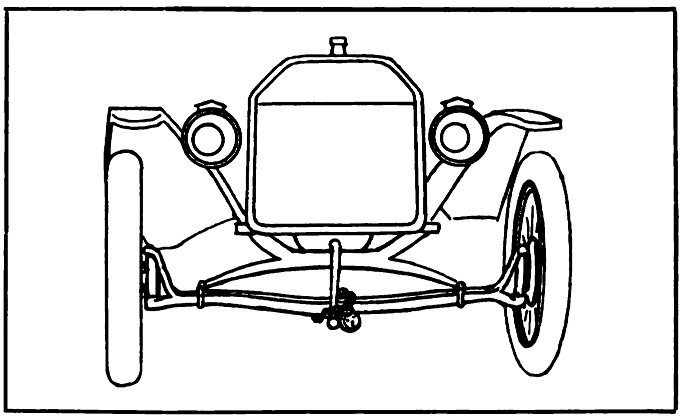

Fig. 16—Starting Crank Chained to Front Axle to Prevent Theft or Use.

assistance of an experienced man. The ring channels should be carefully cleaned before the rings are fitted and plenty of oil should be placed on the rings and cylinder wall.

With care the rings can be expanded sufficiently to pass over the head of the cylinder and into the grooves. When a ring must pass over another groove this can best be done by placing thin metal strips between the piston and the ring. The rings can then be slipped over the strips and into their channels. An example of a good fitting ring is illustrated in Fig. 15 B, and a poorly fitted ring is shown in Fig. 15 C.

ALIGNING A PISTON.

When new connecting rod bearings are adjusted they must not only fit the surface of the crankshaft, but the alignment between the piston and the cylinder must be correct. If the piston is not in a direct line with the cylinder there will be uneven pressure on the wall. This will cause wear on both the cylinder and the rings.

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The connecting rod bearing can be aligned when the crankshaft is on the bench, or a piece of steel may be accurately turned until it is the same diameter as

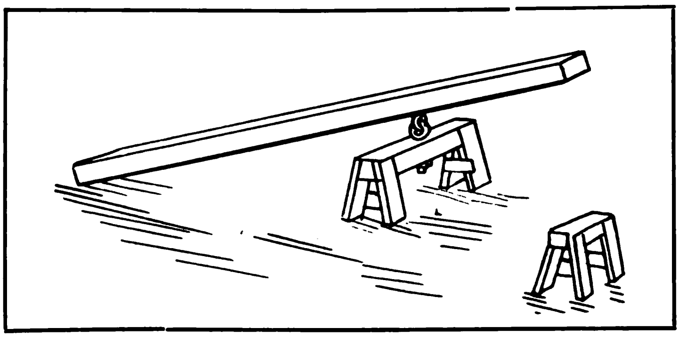

Fig. 17—Improvised Jack of Large Capacity for Use in Raising Large Machines.

the crankshaft. The rod should be securely tightened to the shaft or the bar and placed on two V blocks, as shown in Fig. 15 D. A square should then be placed on the shaft or bar and held against the piston. Any variance from the correct plane will be clearly shown and adjustment should be made. This is best done by scraping the bearing, but there are those who assume that if the misalignment is slight it can be corrected by bending the connecting rod in a vise. While this method might serve in the event of extreme heat, it is not advised. The work must be separated to insure a satisfactory operating cylinder.

QUIETING OVERHEAD VALVES.

There are many methods by which overhead valves may be silenced, some of which are replacing the worn parts with new, inserting fibre washers on the plungers, etc. These repairs are advisable when the parts can be readily procured, but in case they cannot, the valves can be easily made less noisy by the use of small springs. One end of the spring should be fastened around the rocker arm, as shown in Fig. 14, and the other end may be secured to any convenient object. It may be necessary to make an extension of a piece of wire so as to attach the lower end of the spring, as is also shown in the sketch. When the spring is properly placed it will eliminate all the noise that was caused by the valves.

HANDY HOME-MADE JACK.

Much time is lost in garages and repair shops where cars are continually jacked so that adjustments can be made. Many times a jack is not convenient, or all are in use. A practical home-made jack which will always be handy and serviceable is shown in Fig. 17. This should be made of pine timber. The horse should be about 18 inches high and the lever arm may be as long as desired. Place the small end of the lever under the axle and by applying the weight onto the long end a car or truck will be easily lifted. If there is need of keeping the wheel off the ground or floor, a small horse, as shown in Fig. 17, may be pushed under it.

CHAINING A STARTING CRANK.

Many means may be used to prevent an automobile being started except by the owner himself. Some of these are well conceived inventions, while others are adaptations of what are inexpensive materials that are available to all. One owner has found ample protection in a small steel chain and a snap lock. In utilizing this he pushes the cranking handle into mesh with the crankshaft and secures it in that position by a chain wrapped around the handle and the front axle, as shown in Fig. 16. This will securely lock the machine and it cannot be started without attracting much attention, even if one rear wheel is jacked and the high gear placed in mesh, as the crankshaft in motion will ratchet against the crank handle and cause a loud rattle.

REMOVING OIL FROM HARDENED PARTS.

To remove excess oil from parts that have been hardened in oil, place the articles in a small tank of gasoline. After a short period they can be removed and when the gasoline has evaporated they can be polished and tempered without the unsightly mark of burnt oil.

TEMPORARY BLOW OUT PATCH.

If in need when on the road, an ordinary stiff laundered cuff can be used as a substitute for a blow out patch. If no cuff is obtainable a linen collar will serve the purpose. Open the collar and lay it or the cuff over the blow out and place the tube on top. A tire so patched can be used for many miles in event of need.

TEMPORARY WINDSHIELD REPAIR.

A windshield plate of glass that is cracked or slightly broken may be repaired in the following manner: Place a piece of leather on either side of the hole and attach metal plates on the outside, as shown in Fig. 18. A small hole is then drilled through the plates and leather to admit a small bolt. When this bolt is

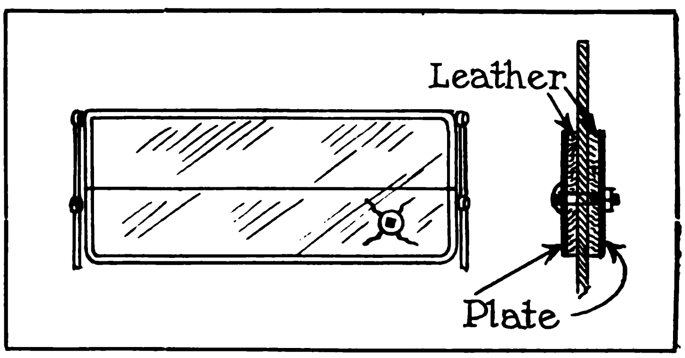

Fig. 18—Method of Repairing Cracked Windshield by Bolting Pads Against Edges of Hole.

tightened it will hold the glass firm and secure and the windshield will be as serviceable as before, and the repair will endure for a long period of time.

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MOTORIZING LONDON FIRE DEPARTMENT.

ALTHOUGH London, England, has been changing from horse drawn to motor driven fire equipment for years, the translation is yet far from completed. It is proceeding rapidly, however, and within a few years the great department that protects from fire 117 square miles of closely built-up territory will be entirely motorized.

The use of motor cars by officers of the department began in 1901, and the earliest effort to motorize apparatus was made in 1902, when a steam engine was converted into a motor driven unit by the addition of a separate steam engine to propel it. About the same time the experiment was made of having an existing steam engine hauled by motor, the front axle of the engine being removed and the two vehicles being made into one with six wheels. Both of these experiments proved unsatisfactory and the equipment was abandoned.

The next step was made in 1905-06, when engines driven by steam motors were tried. It was found, however, that the vibration in going over the pavements at high speed made the boilers leak and the necessity of maintaining a pressure of 100 pounds in the boilers constantly by burning gas proved to be very expensive. The steam system was therefore definitely abandoned in favor of gasoline.

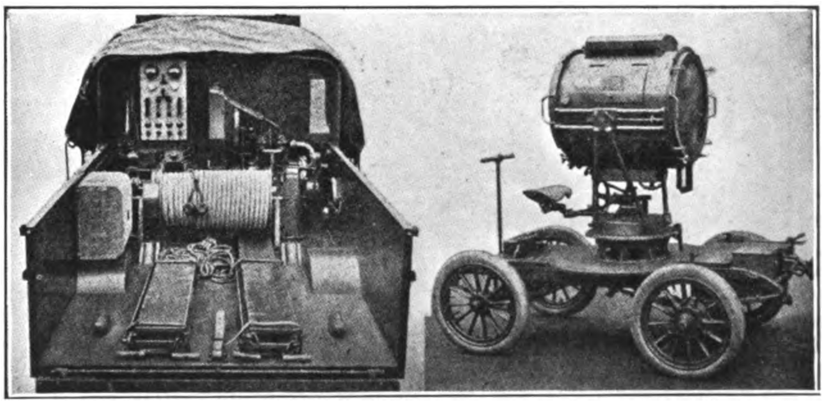
The first gasoline units were not entirely satisfactory. Tires gave trouble and extreme vibration affected the mechanism very frequently. This was due chiefly to inexperience of manufacturers in producing heavy motors, weighing with their loads, about 11,000 pounds. Up to five years ago it was found necessary to have one extra motor unit for every one in service to take its place in case of failure. This proportion has now decreased to one extra for every five in service.

One of the great difficulties with the gasoline units was a tendency to skid at high speeds. Experiments were made to overcome this by the use of chains, steel studded tires and leather tire covers carrying metal studs. Even gyroscopic action was tested, but was abandoned because it caused the apparatus to sway at high speeds and made it very difficult to steer.

This problem has not yet been completely solved, but skidding has been much reduced by using wider tires and covering one front and one rear wheel with extra heavy leather steel studded covers. The type of gasoline pump used by the London department has a four-cylinder engine, five-inch bore and 7½-inch stroke, giving 58 horsepower at 1000 revolutions per minute and 65 horsepower at 1100 per minute. The machines have speed of 35 to 40 miles an hour on the road. The tires are 4½-inch front and 5½-inch rear, both single. The pump is centrifugal, geared from the engine. It has capacity of 500 English gallons per minute at a pressure of over 120 pounds to the square inch.

Electrically driven hose and ladder trucks are also used. A battery of 84 cells of 194-ampere hours capacity provides the power and the truck can run for 30 hours on one charge if necessary. The motors are in the front wheels, the fields being attached to the axle and the armatures to the wheels. The apparatuses have speed of 25 miles an hour on the level and are good hill climbers, but at much reduced speed.

The first cost of the motor driven apparatus is from three to 10 times the price of the horse vehicles (without the horses), but they have much increased efficiency and the much reduced cost of upkeep has been found to be an operating economy of about 50 per cent. Another economy is the reduction in number of apparatuses, and that their mobility is such that fewer stations are required to afford vastly superior service in all parts of the city, especially in the suburbs.



Austin Truck Chassis and the Naval Searchlight on a Hand Drawn Gear for Land Operation—This Is a Novel English Equipment.

MOTOR SEARCHLIGHTS FOR NAVY.

A large naval searchlight, mounted with all its equipment upon a motor chassis, has been produced by the Austin Motor Company of Birmingham, England, for the use of the British navy.

That the light may be used in places where a truck cannot penetrate it has been mounted on a hand drawn car with small wheels and pneumatic tires which is carried in the truck body. Skids or tracks are provided by which this car may be run to the ground. The small car is connected with the truck by a long electric cable for the transmission of current.

The chassis is a standard Austin two-thirds-ton truck. The electrical equipment consists of a dynamo turning at 1000 revolutions per minute, which will produce 120 amperes at 80 volts. The long cable connecting to the light is carried on a reel. The dynamo is driven by an Austin two-cylinder gasoline engine of 12

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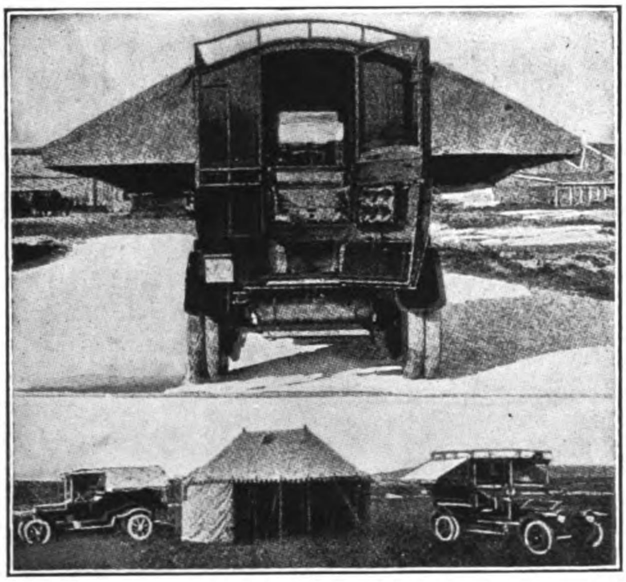
horsepower. This is fitted with a specially designed cooling system and a completely efficient exhaust silencing chamber.

The rear wheels of the small car are fitted with brakes so that in descending an incline it will not run over the crew that is in charge of it. The great 24-inch light is mounted on a swivelled base and can be moved in any direction by worm gears. The seat on which the operator is seated moves in any direction with the light.

The generating mechanism can be used to supply current to officers' quarters or field hospitals.

CZAR'S MOTOR FIELD KITCHEN.

The personal field kitchen of the Czar of Russia, which is used whenever he pays a visit to his troops in the field, as well as the special car in which the kitchen staff travels, are mounted on 50-horsepower Mercedes chassis.



The Motor Kitchen That Accompanies the Czar of Russia Whenever He Is in the Field, and Is at Times His Shelter for Sleep.

The kitchen was especially designed and built for the Czar's use. The front portions of the side walls of the kitchen are hinged flaps, which when let down to a horizontal position are used as auxiliary tables. The kitchen when in movement has the exterior appearance of a closed omnibus.

There is a seat just inside the car at the rear. The side walls are occupied by numerous cooking utensils. At the end of the car are a boiler and a stove of five alcohol burners. Beneath this are refrigerators for meats, butter and wine. Large drawers above the windows carry enough of the imperial plate to feed 12 people.

At the forward end of the roof is a large water tank and above the conductor's seat is a large wash basin of the folding type. The auxiliary vehicle, which has glass sides, carries a tent and 10 folding chairs, in which the attendants ride. At night these chairs can be arranged into a very comfortable bed for the Czar.

TOMMY ATKINS' MOTOR BATH.

The need of cleanliness in keeping troops feeling fit and capable is recognized by all military leaders. So that Tommy Atkins can bathe regularly the English army authorities have designed a motor "bath wagon," that is now in use in the operations in France. One of these is already in use and if the war continues it is likely that many more will be placed in service.

The motor bath is mounted on a substantial chassis with a closed body. Twelve collapsible canvas tubs are carried. When folded the tubs occupy a small space inside the car, but when in use they afford very comfortable bathing facilities for a fair sized squad. When in use six tubs are placed on each side of the body and covered over with tents. A canvas sheet is spread over the ground. The poles for the tents and the wooden gratings for the soldiers to stand on while they dry themselves are carried on the roof of the car.

The motor bath carries 60 gallons of water and the heating apparatus within the body consists of two circulating tube boilers, beneath which are burners to which kerosene is fed under pressure. Water is heated to the boiling point at the rate of four gallons a minute and the whole 60 gallons can be heated to close to boiling in a very short time. Fresh water is taken into the main tank by a hand pump. Fuel for the burners is carried in a six-gallon drum on the running board.

Water is drawn into the tubs by hose connections with two taps on either side of the car near the front. The motor bath is designed especially for use in connection with temporary hospitals near the front and for the men in the trenches.

PRODUCE SYNTHETIC RUBBER.

Germany has been shut off completely from any supply of rubber by the British navy, and large quantities of rubber are absolutely necessary for tires, if the war is continued. A satisfactory means of making synthetic rubber is stated to have been found by German chemists and a great new $10,000,000 factory has been fitted out by the government for manufacturing it.

So far the stock of tires on hand at the beginning of the war has been drawn upon, but it is said tests of the new rubber have shown it to have excellent quality for making tires, though the cost of production is considerably higher than that of natural rubber when it is available.

'BUSSES MAKE MONEY IN BERLIN.

In spite of the war the omnibus lines of Berlin, which were forced during 1914 to carry 5,000,000 soldiers free, have been able to declare a dividend of 7½ per cent. on their capital stock. This is especially remarkable through the fact that the war has reduced the number of 'busses in operation by about two-thirds.

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STANDARDIZING MILITARY TRUCKS.

The present war has produced some valuable experience regarding the proper methods of operating motor transport, and one of the important results so far emphasized is that the best results are obtained when the fleets serving each section of the line are all of the same make and model.

This makes it possible to equip the field repair shops serving that section of the army with a complete stock of repair parts for the trucks in use there. If a mixed fleet is in operation the great variety and number of parts that must be kept on hand make an overwhelming problem.

It has been urged by English truck experts that obsolete models be retired as far as possible, even though they are in condition to give good service. The reason for this is that the manufacturers now have their plants operating on current model production and that a demand made upon them for parts of obsolete models makes it necessary for them to interrupt their work on new production, adjust their machines for the old parts and delay the output of new trucks. Thus to keep the old trucks in operation the government interferes with its own supply of new trucks.

The one great advantage that the military repair shops have over commercial repair shops is that they can take any course in making a repair that may be necessary to insure the highest efficiency without regard to cost. In all other respects the conditions of their operation are more difficult.

MOTOR CHAPELS FOR GERMANS.

Three motor chapels have been donated to the German army by a Cologne newspaper. These are already at the front. A spacious driver's seat, which will carry two persons, is so arranged that it may be converted into a couch. A stretcher is carried inside the car on which an additional bed may be made.

The car is entered through a door at the side. There is a closet provided in which the garments of the priest may be stored. At the front of the car is a table, which will serve both as a writing desk and washstand.

At the rear of the car is the altar compartment. This is covered by a folding roof, which affords full protection for the chaplain in inclement weather. He conducts his services standing in the rear of the car and addressing the soldiers from behind the altar. Large red crosses adorn the sides of the car.

MOTOR VEHICLES IN GREAT BRITAIN.

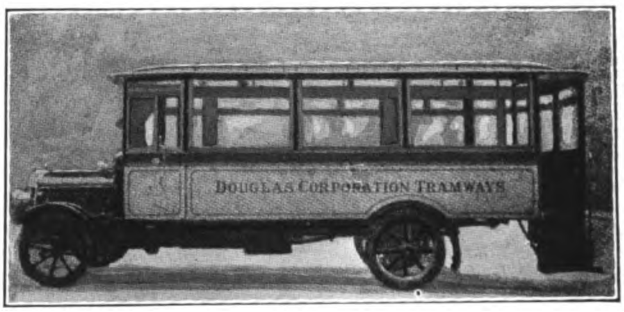
In view of the fact that latest registration figures show that there are 1,754,570 motor vehicles in the United States, and that during the last year there was estimated an increase of more than 500,000, it is interesting to note that the latest figures for Great Britain place the total number of machines in use in all the countries of the United Kingdom at only 341,250.

Of this number 132,000 are motorcycles, 136,000 are privately owned automobiles, 36,500 are cabs and the remaining 32,250 are motor trucks. Of these latter there are 11,700 gasoline machines of over two tons capacity and 3500 steam trucks of the same size. Of the 17,050 commercial cars having capacities less than two tons, 3050 are of three-wheeled type.

England and Wales have about 10 times as many vehicles as Scotland, and Scotland has between three and four times as many as Ireland. For commercial machines the exact comparisons show 10,000 for England and Wales of more than two tons capacity, 1500 for Scotland and 200 for Ireland.

GAS-ELECTRIC 'BUSSES IN LONDON.

'Busses of gas-electric design have been tried in service in London and have been found very satisfactory. They are made by the Tilling-Stevens Company. Advantages claimed are the elimination of gear shifting with the consequent jar, and the great wear and tear on that part of the mechanism in 'bus service, and the smoothness with which speed may be accelerated or retarded.



Type of Gasoline-Electric Omnibuses That Have Been Found Extremely Efficient in London Service.

This additional flexibility has been found to reduce materially the likelihood of traffic accidents. English merchants, however, as always, are conservative, and as electrical machinery is not so well known and understood in England as in the United States, it has been difficult to introduce the gas-electric chassis into commercial work, so that the same company makes as well a straight gasoline type.

EXPOSITION BUYS OVERLANDS.

Officials of the Panama-Pacific Exposition have authorized the purchase of three Overland light delivery cars for the use of the electrical department, which has to keep in operating condition the thousands of lights and signs upon the grounds.

The cars will be in service night and day, as they are to be used for what electricians call "shooting trouble," and must answer calls at all hours. Three other Overlands were recently purchased by members of the New York state commission for the purpose of entertaining distinguished guests at the grounds.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

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Anonymous communications not considered. Correspondence on subjects relating to trucks, delivery wagons, taxicabs, tractors, all motor driven farm, fire and municipal apparatus, the motor industry and the trade, will receive attention. Stamps must be enclosed to insure return of unsolicited contributions.

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BUSINESS MEN BUYING TRUCKS.

That business men the country over are buying motor trucks and wagons, and acquiring them rapidly is shown by registration statements. In Massachusetts, for instance, to June 1, the total number of motor trucks and wagons registered was 9336, or 1100 more than was registered during the whole of 1914, and the total number of automobile vehicles registered was 77,246, or 921 more than in 1914. During the same period of 1914, 72.35 per cent. of the total for the year was registered, and with this as a basis for comparison, there is reason to expect that the total truck registration in the state for the year will approximate 12,000. The increase of the date specified was 14.65 per cent. more than for all of 1914, and the probability of this percentage being tripled is well founded. The facts with reference to other states are not known, but if they parallel those of Massachusetts there is apparently a fairly good year in prospect for the industry without war orders.

RETURN OF WAR SERVICE TRUCKS.

The supposition that at the conclusion of the European war there will be sale by the governments of thousands of motor trucks, many of which will be returned to the United States for obvious reasons, is not idle speculation. Were these machines largely placed in the American market at prices that would attract buyers, there is good reason to apprehend a condition that would materially affect the industry and those dependent upon it. Whether or not existing customs laws would apply to the return of American products after use abroad sufficiently to prevent the market of the United States being a dumping ground for trucks that would be sold for very low prices is a question, but there is abundant reason to demand that such measures be taken by Congress as shall prevent a material effect upon the industry.

TRUCK SERVICE IN ACTUAL WARFARE.

Statements made on seemingly well founded judgment are that motor trucks "last" about 30 days in the service of the different nations now at war in Europe. This is assumed to mean the average period of use before accident in some form necessitates varying degrees of restoration. Expense is not considered and results are demanded at any price. Without question the war has revolutionized accepted transportation methods so far as military service is concerned, and there is reason to believe that the army transports of the future will be designed to more nearly meet the requirements than do those now in use. Practically all vehicles in the service of any of the nations are designed for commercial purposes and not intended to endure the conditions that apparently demand battleship construction. When conflict was precipitated the military authorities seized machines of all kinds and no choice of design or especial quality is represented by what are now utilized. And what are bought in America are what can be quickly obtained without regard to engineering preference.

TAXES BASED ON TRUCK WEIGHT.

Motor truck taxes are generally based on load capacity, for there is apparently belief by legislators and the public that automobile vehicles will wear highways in ratio to the weight—that is, that the load upon the road surface is the measure. As a matter of fact the heaviest motor trucks, when fully loaded, have comparatively small weight, supported by the square inch of tire surface area in contact with the ground, and in comparison with the weights carried by the average steel tire the pressure is such that it must be abandoned as a factor of importance. As the load on rubber tires is increased the supporting surface increases, and as rubber cannot be compressed and is distorted to conform to the surface on which it rests, this means that with the tire and wheel sizes now in use, and with maximum loads, the increase of tire area on the road from compression is automatically kept well within what may be regarded as safe limitations.

Engineering and scientific data, that cannot be controverted, if used by the owners and operators of motor trucks, would prove to law makers that the actual weight carried on rubber tires is from 60 to 80 per cent. less to the square inch of surface contacting than with metal tired vehicles, and if load is the real factor, that the latter type of conveyance should be heavily taxed for road maintenance.

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INTERNAL GEAR DRIVEN REAR AXLES.

Oldest American Development and Most Used Construction the Torbensen Design—High Efficiency Obtained by Skilled Engineering and Expert Workers.

POWER transmission systems adapted for automobile vehicles are not numerous. The chain was utilized for bicycle propulsion because it was positive as compared with a belt, but the shaft drive was found to be more constantly efficient, because it was protected. Cleaned and lubricated, the chain afforded admirable results, but its efficiency quickly decreased from wear, lack of lubricant and the accumulation of road material that absorbed the oil or grease and restricted free movement of the links.

With the adaptation of chains for the propulsion of pleasure cars, the bicycle experience was repeated, and this led to the use of shafts. The automobile that is intended for pleasure and is chain driven is almost a curiosity today, not because chains are not efficient, but because of the care and attention necessary to maintain efficiency, which is obviated with the shaft drive, which is fully protected so that its endurance is equal to requirements.

Type of American Light Truck Equipped with the Rear Axle Made by the Torbensen Gear and Axle Company.

But with service vehicles conditions materially differ. Economy is the main factor. The construction that will longest endure, which requires the least care and attention, which is uniformly efficient, which will afford standard service with minimum fuel and lubricant, which is least destructive of tires and which will, in the event of needed restoration or repair, be thoroughly understood by average automobile mechanics, is that which appeals to the practical business man. The chain drive has been used by motor truck and wagon engineers and manufacturers largely from the fact that the shaft and bevel gear drive is impractical, a sufficient reduction requiring a master gear of such size that a standard wheel size would not afford the necessary road clearance, as well as adding to manufacturing cost. Were the transmission gearset ratios increased in number this would increase production expense and not obtain the desired result. This general statement is applied broadly, for pleasure cars have been converted for freight carrying, and many small shaft driven machines are built, that are practical enough, although the economy from the other viewpoints may be questionable, and is meant to include the classes of vehicles designed purposely for freightage.

Protection of Driving Systems.

The same factors obtain with the chain drive, although it is recognized as positive and dependable, when used for trucks or wagons, as with pleasure cars, but the vital quality of economy has prompted the consideration, and it will influence the eventual adoption of other methods of propulsion. Americans have clung to the chain for freight vehicles until within a comparatively short time. European engineers, impelled by more cogent needs of economy, have developed two other forms of drive—the worm shaft and gear wheel, and the internal or ring gear and spur pinion. These have been used and experimented abroad and are more generally the vogue than the chain. Worm gearing has been used for many years for driving shafting, but it was first applied to motor vehicles in England by Lanchester, who used the worm shaft, carried beneath the worm wheel, and by David Brown, who used it above the wheel. The Lanchester construction is used in this country by one or two manufacturers, and practically all of the worm driven machines in service in America, or made by American manufacturers, are the David Brown type.

Continental European truck builders, however, turned to the internal gear, and this system of drive has been developed and perfected by German, French, Austrian and Italian manufacturers, and in these coun-

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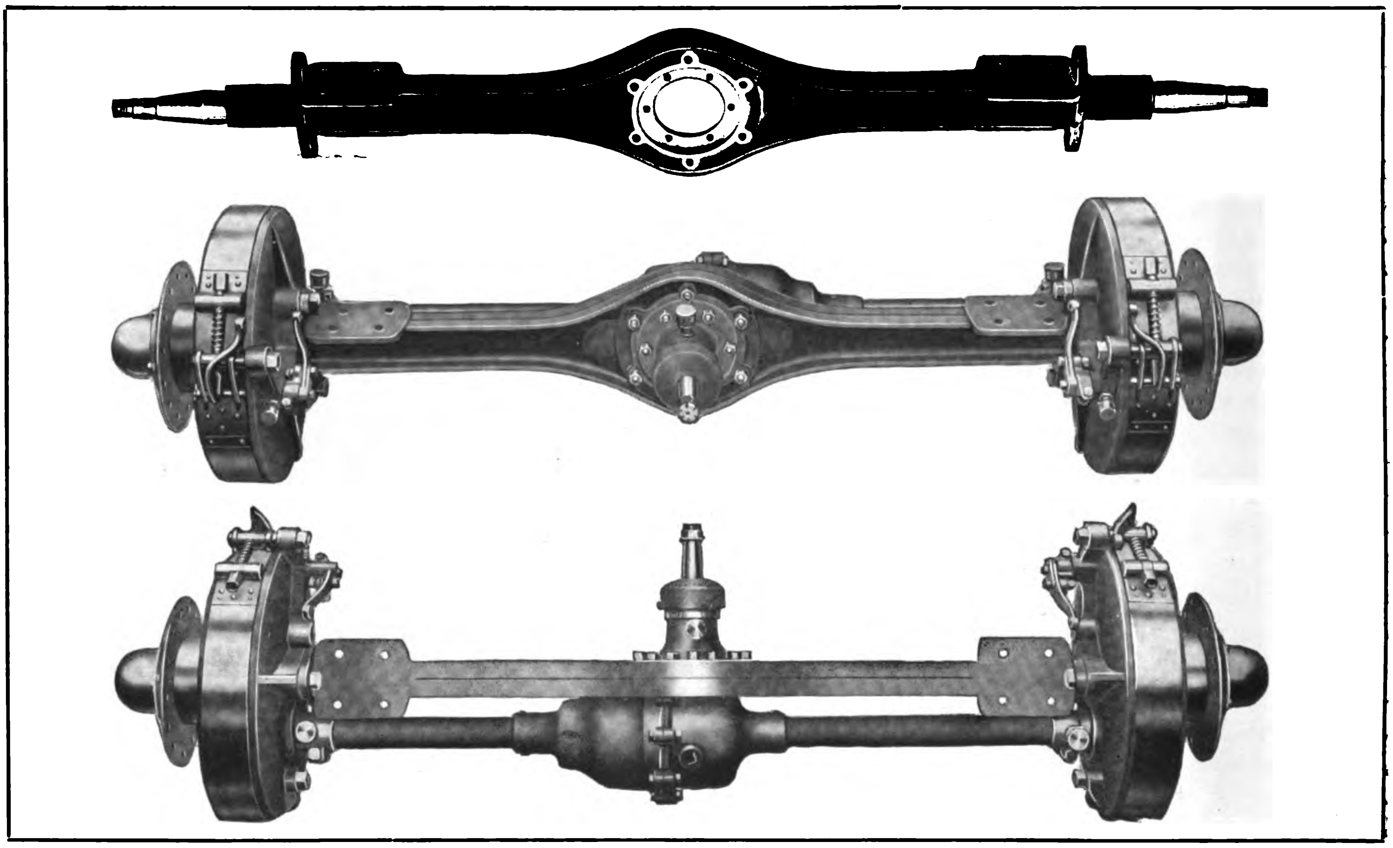
tries and in Belgium, Switzerland and some of the smaller nations these machines have been approved by the governments after the most exacting trials and competitions to determine serviceability for military purposes. In Germany and France, where the tests were made annually, and in which all the leading manufacturers participated each year, with subvention premiums as incentive for development, the internal gear has been regarded as being superior to all other forms.

Efficiency of the Internal Gear.

The reasons which prompted the determinations of the military engineers were the uniform efficiency of the internal gear at all speeds and in all conditions of operation, the thorough protection of the moving surfaces in contact, the light weight and the simplicity ure and the purchasers of machines were not engineers and they were not sufficiently informed to discriminate. The first internal gear driven vehicles used in this country were the De Dion 'busses of the Fifth Avenue Coach Company of New York City, and a considerable number of axles were imported from Europe and installed in the machines. That these axles are still in use, enduring service that necessitates constant starting and stopping, and carrying heavy loads, is a very strong recommendation of this construction and system of power transmission. The internal gear driven axle is now used by a considerable number of vehicle manufacturers, the demand for 1914 being 100 per cent. more than in the preceding year, and for 1915 the demand will be increased more than 400 per cent. as compared with 1913.



At Top—Finished I Beam Dead Axle of the Torbensen Type; at Centre, Front View of the Complete Torbensen R-I Rear Axle with the Brake Assembly; at Bottom, Top of the Torbensen R-I Rear Axle, Showing the Light and Compact Construction.

with reference to mechanical care, as well as the extreme endurance.

In America the internal gear is not new. It was originated about the same time in this country as the English engineers took up the worm, for in 1901 V. V. Torbensen, then factory manager of the American plant of the De Dion-Bouton Motorette Company, designed, built and put into operation the first internal gear driven used in this country. In May, 1902, patents were issued to Mr. Torbensen covering this form of power transmission. After leaving that concern he continued to build internal drive rear axles, and these were used to some extent.

Torbensen Ahead of Industry.

Mr. Torbensen, however, was ahead of the industry, as motor vehicles were then used only for pleas-

The advantages claimed for the internal gear drive are that the load is carried by a dead axle; that the construction may be as much as 100 per cent. lighter than other types of axles; that the power can be applied as near the rim of the wheel as may be desirable, instead of directly at the hub, vastly increasing the leverage and decreasing the power necessary to propel a given load; that any ratio of gear reduction can be obtained; that it is absolutely simplified and cannot be mechanically deranged by service; that it is extremely enduring and will afford service for a very long period; that the only parts that can wear are the spur pinions, which can be replaced at trifling cost; that the internal gear and pinion can be driven without lubrication without deterioration; that friction is minimized; that efficiency is always uniform, and that this

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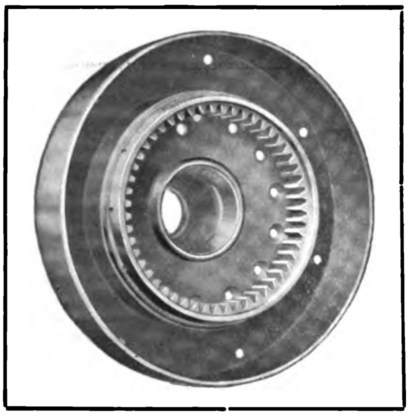
construction is as efficient as the chain drive, with all the protection that is necessary to the highest economic service.



The Wheel Hub Assembled with the Internal Gear and Brake Drum.

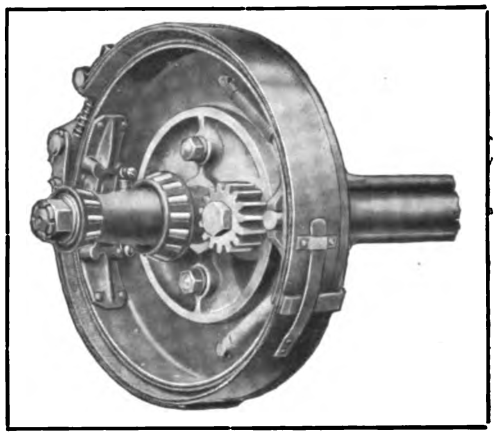
The Torbensen axles, which are adapted alike for gasoline and electric vehicles, represent the continuous development of this form of drive in America. They are constructed under patents granted July 16, 1912. This type has been taken for a review of internal gear drive as representative, it being the production of the man who first originated it in America.

Incidentally, statement can be made that the plant of the Torbensen Gear and Axle Company, which has been for a number of years at Newark, N. J., has been removed to Cleveland, where it has been established at East 72nd street and the Lake Shore and Michigan Southern railroad, and where production was begun June 15. This plant is splendidly equipped and it now has a capacity of 50 sets of axles daily.

Efficient Production Facilities.

Manufacturing Torbensen rear axles exclusively, the equipment of the Torbensen Gear and Axle Company has been selected with the purpose of obtaining first a very high standard of accuracy, and second of insuring the largest measure of economy. The experience of the company has made practical engineering economies that are in the main directed toward increased production, this referring especially to fixtures that insure uniformity of processes in the standard types, to special tools and methods of assembling, and to reduction of metal losses and minimized labor.

Torbensen axles are constructed to meet the requirements of the manufacturers of gasoline and electric vehicles, and the claim is made for them that they are especially desirable for electric vehicles because of the minimized loss of power through friction. Obviously, this characteristic is as desirable for gasoline machines as for electric, for the cost of fuel and lubricant are large factors in operating expense.



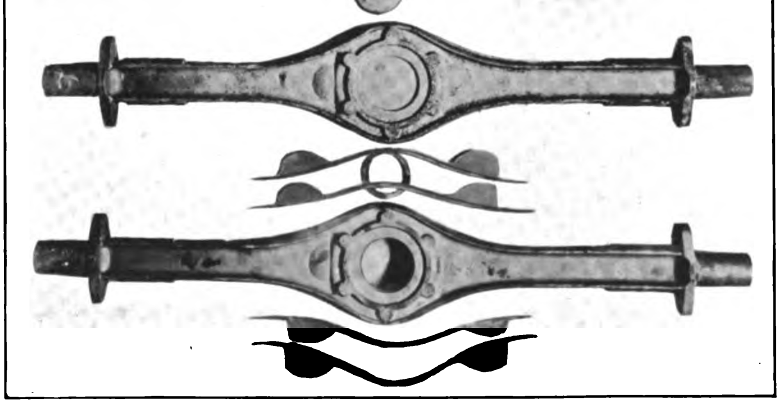
The Axle Spider, Wheel Spindle, Driving Shaft Pinion and the Internal and External Brakes.

Examination of the accompanying illustrations will show that the Torbensen axle is built to a design that is intended to afford extremely light weight, as well as sufficient strength, and that it is essentially a combination of a jackshaft and a dead axle. The design is the development of more than 14 years' experience, and aside from proportions, it is identical in the axles of different capacities that are now built. The company is now producing axles that are intended for use with vehicles that are rated for loads of 1500, 2000, 3000 and 4000 pounds, and the purpose is eventually to build other sizes to a maximum capacity of 10,000 pounds.

All Types to Practically One Design.

As there is but one design, the description of manufacturing that follows will refer to processes and not to dimensions of each size, although the detail will be of the R-I type, which is rated at 2000 pounds capacity.

The axle itself is drop forged from .30 to .40 carbon steel, the metal being originally in billet form, and after four separate operations in the dies it is shaped in readiness for machining. The metal previous to and after three of the forging stages is shown in an accompanying illustration. Noting this, one will learn that the forging is an I section with what is technically referred to as an "enlarged" centre, the web of the I being approximately three times the width at the centre that it is at the narrowest points. This enlarged centre is cut with a circular opening which, for



The Dead Axle of the Torbensen Type in Three Stages of Forging, from the Steel Billet to the Finish of the Die Work.

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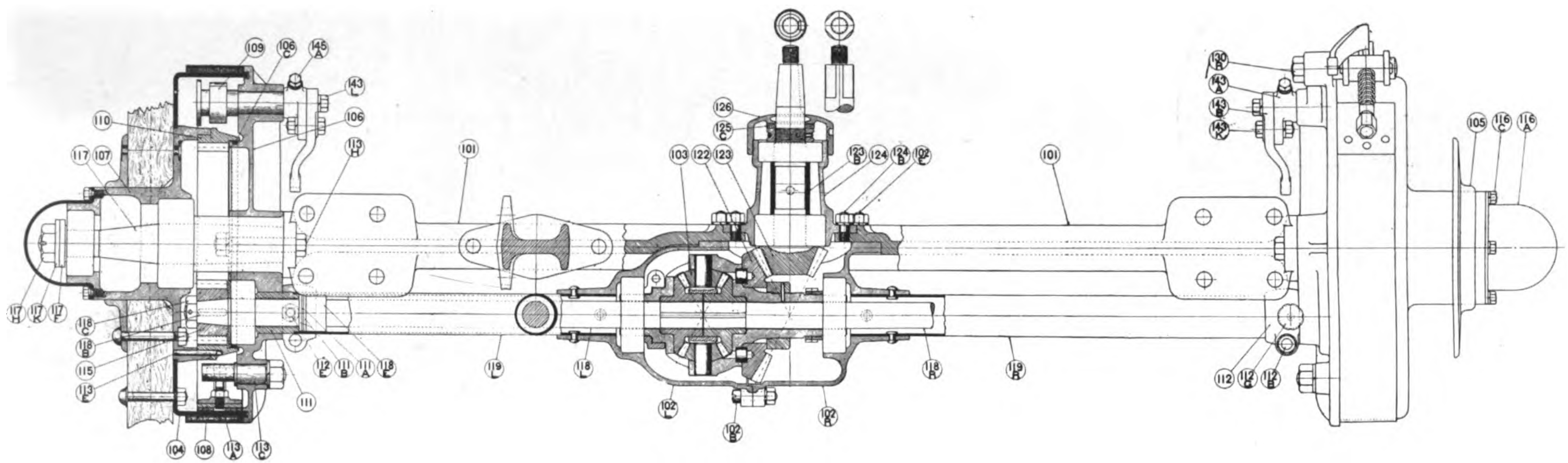
TORBENSEN GEAR AND AXLE CO.
CLEVELAND, OHIO

Type "R-I" Axle
Internal Gear Drive



No.	Name
101	I Beam Axle
102-R	Differential Housing—R. H.
102-L	Differential Housing—L. H.
102-B	Cap Screw
102-E	Stud
103	Differential
104	Brake Drum
105	Hub Flange
106-R	Cover Plate—R. H.
106-L	Cover Plate—L. H.
106-C	Oil Ring
107	Hub
108	Internal Brake
109	Brake Cam

No.	Name
110	Internal Gear
111	Jack Shaft Retainer
111-A	Steel Washer
111-B	Fibre Washer
112	Jack Shaft Clamp
112-B	Cap Screw
112-E	Set Screw
112-G	Grease Cup
113-A	Adjusting Screw
113-C	Eccentric Stud
113-E	Gear Pin
113-H	Cap Screw
115	Spur Pinion

No.	Name
116-A	Hub Cap
116-C	Cap Screw
117	Spindle
117-F	Adjusting Nut
117-H	Adjusting Nut Washer
117-K	Spindle Nut
118-R	Jack Shaft—R. H.
118-L	Jack Shaft—L. H.
118-B	Key
118-C	Jack Shaft Nut
118-E	Jack Shaft Collar
119-R	Jack Shaft Tubing—R. H.
119-L	Jack Shaft Tubing—L. H.

No.	Name
122	Bevel Gear
123	Bevel Pinion and Shaft
123-B	Spacing Tube
124	Propeller Shaft Housing
124-B	Stud
125-C	Felt Washer
126	Cap
130	External Brake
143-A	Lever Centre
143-B	Brake Lever
143-K	Cap Screw
143-L	Cap Screw
145-A	Cap Screw

SPECIFICATIONS—TYPE "R-I" AXLE.

Capacity ....3500 Lbs. (Truck and Load) on Rear Axle
Track ....56"—C. to C. of Spokes
Spring Centres.......39½" Maximum—C. to C. of Springs
Width of Springs....2¼" or 2½"
I Beam, Drop Forging 3"x2"
Brake Drum..........15" Diameter
Brakes
External ....15"x2½"
Internal ....14½"x2"
Hubs ....12 or 14 Spokes

Internal Gears
Gear Ring ....51 Teeth, 1⅜" Wide, 6 Pitch
Pinion ....15 Teeth, 1⅜" Wide, 6 Pitch
Bearings
Inner Hub ....309-N Roller
Outer Hub ....306-N Roller
Jack Shaft ....306-N Roller
Differential ....209 D. R. Ball
Pinion Shaft......307 D. R. Ball
207 D. R. Ball
Weight, with Hubs..365 Lbs.

GEAR RATIOS AVAILABLE.

Teeth in Pinion	Teeth in Gear	Pitch	Final Ratio
13	20	4	5.25:1
12	21	4	6.00:1
14	27	4½	6.50:1
13	27	4½	7.00:1

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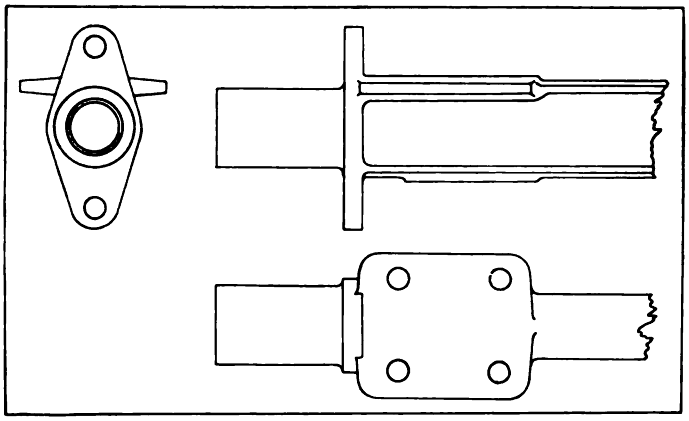


The Formation of the Spring Seats and the Brake Spider Flange and the Wheel Spindle Stub.

the purposes of description, will be termed the "eye," and about this is formed a heavy ring of metal, from which project bosses. The metal about the "eye" is recessed in the forging, this being later machined to seat the housing for the propeller shaft. This illustration is of the front side of the axle. At either end of the axle the spring seats are formed integral, and there are outside of these two pairs of lugs, which are intended to carry the spiders or flanges which enclose the internal gearset and the internal brake, as well as carrying the brake shafts. These flanges also support the outboard ends of the jackshaft.

I Beam Special Drop Forging.

The forging dies are designed to shape the axle so there will be a minimum of machine work. The reader will note, however, that the forging does not have the wheel spindles formed. As forged, the axle is I section between the lugs for the flanges, with two short, round stubs extending beyond the lugs. The form of the central section of the axle is such that it will endure a very heavy load, although comparatively light, and the ring and the series of bosses encircling the "eye" greatly strengthen the beam. There has never been an instance of an axle yielding under the stresses of a load. The statement may be made here that any axle of a uniform section is weakest midway between the points of support, which are the centres of the wheels on which it is mounted. The increased width of the I at the centre insures endurance under load and obviates possibility of sag from extreme stresses.

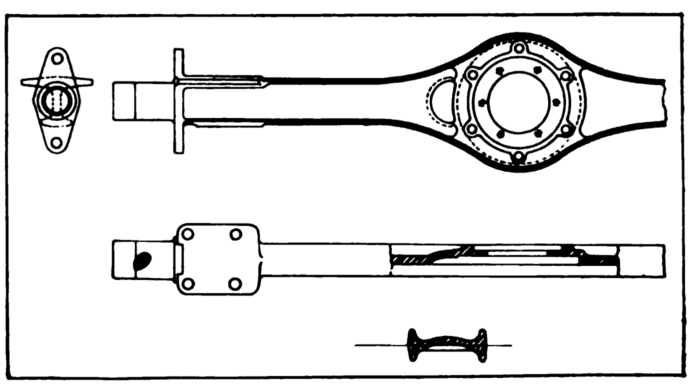
When the axle has been forged it is heat treated. When delivered at the factory it is in readiness for the machining, which is extremely important work. The round stub ends are turned, and then bored to a depth of four inches. These holes are the full width at a point that corresponds to the outside lines of the lugs. As these holes are fitted with the axle spindles, great care is necessary that they be exactly lined, so that the wheels will be in truth when mounted. There are other considerations that will be referred to later. The ring and bosses on the front side of the axle are next machined.

The "eye" is cut so that it is in the exact centre, and into the ring surrounding it is cut a concentric recess. The bottom of this recess and the face of the ring must be in exactly the same plane. Reference to the illustration of the front of the finished axle will show that the faces of the ring and the six bosses that surround it at 90-degree intervals on centres, are finished in the same operation. Into this recess is later fitted the shoulder of the housing of the propeller or pinion shaft. On the rear side of the centre a recess is machined that is concentric to the "eye," this being slightly larger than the recess on the front side. The diameter of this recess is approximately indicated by the bosses surrounding the "eye" on the front side. Into this is seated the shoulder of the differential housing of the jackshaft.

Because the pinion of the driving shaft and the bevel gear of the jackshaft, and the driving shafts and the wheel spindles must be in perfect alignment, to minimize friction, economize fuel and lubricant, as well as insure against wear, extreme care is taken in machining the axle. Each operation must be identical, for the slightest variance would be a matter of material consequence so far as efficient operation is concerned. This statement applies equally well to the reaming of the holes in the stub ends of the axle beams. These are reamed to the full depth of four inches to a taper of a half inch to the foot to take the chrome vanadium steel axle spindles.

Wheel Spindles Shrunk in Axle.

These wheel spindles have the usual taper from the outer end, and are machined and ground to a size that is slightly larger than the bore of the axle stub. The spindles are double heat treated before they are finished and when the machine work on the enlarged centre has been partly completed the axle ends are heated and the spindles are dropped into the holes to a gauged depth. When the axle ends are cooled the contraction of the metal holds the spindles so firmly that they cannot be removed save by drilling, and they are practically integral with the forging. The end of the axle stub forms a shoulder about the spindle, extending nearly to the centre line of the spokes when the wheel is installed, so that there is but slight bending moment of the spindle. The spindle has no sharp turned shoulder, as has axles of other construction, the fibers of the metal are not cut, and there are no cor-



Section of the Rear Axle, Showing the Expanded Centre, the Spring Seats and the Brake Spider.

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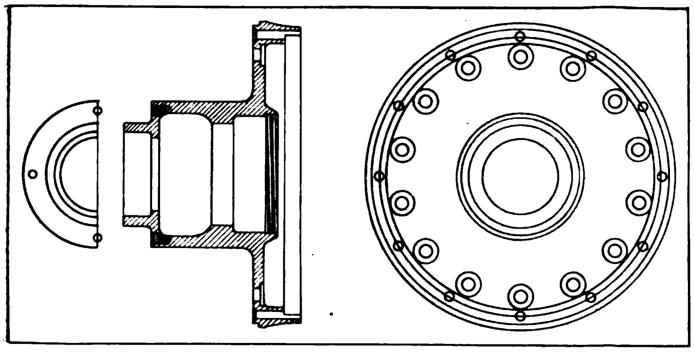


The Formation of the Wheel Hub, to Which Is Fitted the Internal Gear and the Brake Drum.

ners or fillets where vibration would tend to granulate the metal. Normally the ends of the axle carry a fifth of the load. The inner wheel bearing is seated against the shoulder.

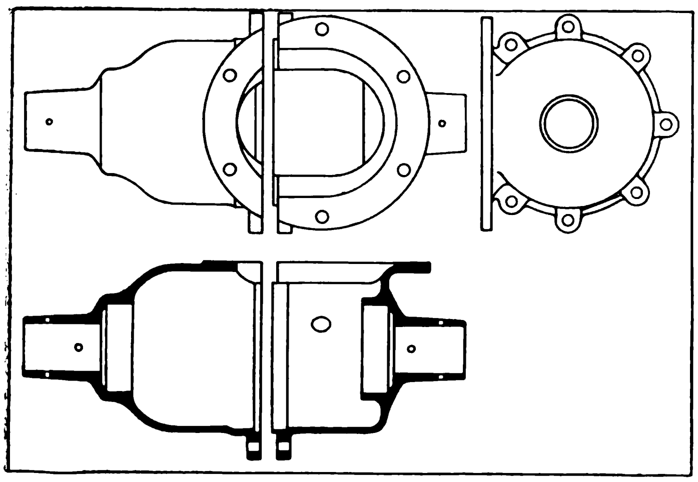
Fitting the Centre Recesses.

Following the fitting of the axle spindles the axle is placed in a drill press and both sides of the expanded centre are faced, and the shoulders are milled to size to form sides for the flanges of the propeller shaft and differential housings. Holes are drilled in the bosses on the front side, and in the recess, equidistant between the bosses, are drilled six additional holes. The location of these will be seen by reference to an illustration. The inner row of holes are tapped to receive studs that retain the housing of the pinion shaft, and the outer row in the bosses are for six studs that extend through the axle and are tapped into the differential housing, both series of studs being secured by nuts.

At either end of the I beam is the lateral flange or lugs, to which the cover plate or spider of the brake drum is bolted. These are drilled for the bolts that retain the spiders. The spring seats are forged integral with the axle and are very generous in size, for the driving and torque stresses are taken through the springs, no torque arms or radius rods being used with this construction.

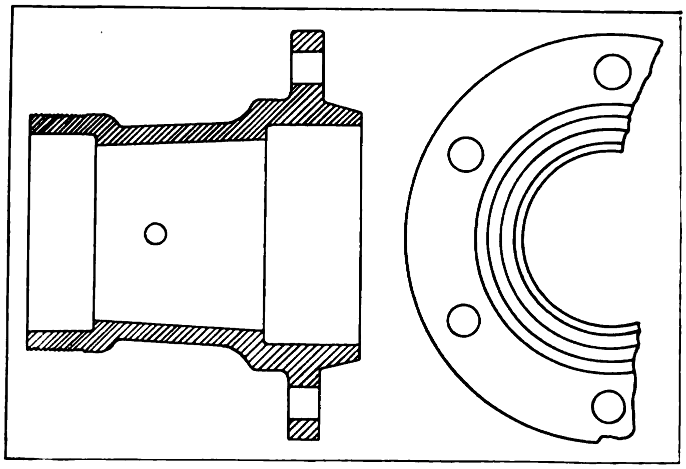
Differential Housing Very Light.

The differential housing is of malleable iron and is cast in two sections. It is divided approximately in the centre, the transverse line of division having a tongue and groove construction to insure against leakage, and the better to resist strain, and the halves are retained by a series of cap screws. On the front side of the housing is an annular flange that has a shouldered engagement with the recess in the expanded centre of the axle. Internally, the housing is machined for the seats for the two double-row annual ball bearings that carry the differential gear assembly and the master bevel gear. Each end of the housing is machined for the seamless steel tubes that enclose the driving shafts of the jackshaft. These tubes are secured to the housing by rivets and extend to the spiders at either end of the axle.



The Sectional Housing for the Differential Gear and Bevel Gear of the Jackshaft of the Torbensen Axle.

A glance at the sectional drawing axle assembly will show that the differential assembly is not conventional. The differential gearset and the bevel gear are a standard Brown-Lipe-Chapin construction, but to economize weight and space the bevel gear is small and it is mounted beside the gearset, instead of on it,



The Propeller Shaft Housing, Recessed to Carry the Annular Ball Bearings.

as is the prevailing practise. Because of the necessity of carrying the gearset at the left side of the bevel gear, the housing has the appearance of being off the centre of the axle. Reference to the drawing will clearly indicate its position, and show that the desirability of having the jackshaft close to the axle has impelled this construction. The bevel gear, although small, affords ample reduction. Statement may be made here that gear reduction is obtained in the transmission system gearset, the driving pinion and bevel gear, and in the spur pinion and the internal ring gear of the wheels. The differential gearset gears are nickel steel and are carefully cut and finished.

The spider or cover plate is a ribbed malleable iron flange that is fitted over the end of the axle stub and is solidly bolted by two large bolts to the transverse flange on the axle. As will be seen in an illustration, the spider serves as a cover for the internal gears and the hub and for the brake drum. It is supported by the round trunnion or end of the axle and by the bolts, and the ribs insure ample strength. The spiders sup-

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port the outboard ends of the jackshaft housing, and carry the bearings for the outer ends of the driving shafts. On the spiders are bosses in which are placed the anchor studs for the internal brake shoes and the shafts carrying the cams that expand the shoes. The anchor studs are at the rear of the spiders and the camshafts at the front. The external brake shoes are anchored to lugs on the front of the spiders. Between the anchor studs and the bearings for the camshafts are annular rings, these being machined to coincide with flanges cut on the internal ring gears.

The Jackshaft Driving Shafts.

The jackshaft driving shafts are forged from chrome nickel steel, heat treated, and in the 2000-pound capacity axle these are 1 3/16 inches diameter. These are comparatively light for high-speed service, but as they are not subjected to stresses other than those of driving, they have ample strength for all requirements. These shafts are squared at the inner ends to engage with square holes in the differential bevel gears, and the engagements are floating, so that there is no end thrust on the gears. The outer ends of the shafts are tapered and ground to size, and on these are fitted the case hardened nickel steel pinions that drive the internal ring gears, the pinions being retained by keys and by pinned nuts. The jackshaft shafts are held in place by nickel steel collars shrunken on to them, which are shouldered against bushings which extend from the retaining collars to the annular double row ball bearings on which the shafts are mounted. Any end thrust is taken and absorbed by two fiber washers and one steel washer on the shafts between the retaining collars and the bushings. A clamp collar holds the jackshaft tubing to a shouldered recess on the bushing, and should occasion require the removal of the pinion, bearing, collar and shaft from either side of the jackshaft, this may be done by loosening the clamp and turning a set screw which spots the bushing.

Internal Gear and Wheel Hub.

The internal gear is incorporated with the wheel hub. The hub is a malleable iron casting that is machined to carry two annular roller bearings on which the wheel revolves on the axle spindle. The hub is formed to have a shouldered engagement with the internal ring gear, to which it is secured by 12 keys or pins that are centred 30 degrees apart and which are pressed into place. When the ring gear is pinned to the hub it is practically integral. The inner edge or flange of the internal ring gear extends over the annular flange or ring on the spider. In this ring is cut a groove or channel, in which is fitted a brass packing ring, which is in frictional contact with the flange of the internal ring gear, which prevents any lubricant from leaking from the chamber and makes the entrance of dust or foreign matter practically impossible. When the axle is in service the wheel bearings and the internal gear and the driving pinion are constantly lubricated. The internal ring gear is cut from a steel drop forging and is hardened, and the spur pinion is case hardened nickel steel, so that wear is practically negligible. The internal ring gear has 51 six pitch teeth, and the spur pinion 15 six pitch teeth, this affording a reduction of approximately 3½ to 1. Obviously, by varying the ratios of the gear and the pinion, any desired reduction could be obtained. The first reduction in the axle is from 1½ to 1 to 2½ to 1, according to the final reduction.

Brake Drum Encloses Gear.

The pressed steel brake drum encloses the internal ring gear and the internal brake. The drum has a shouldered engagement against the inner flange of the wheel hub, and it is secured to the spokes of the wheel by a series of bolts. The inside edge of the drum fits into a channel or groove in the spider, so that the internal brake assembly is completely enclosed, and as this construction is practically dust tight, there is no probability of the brake being affected by the admission of foreign matter or abrasives. This protection insures the brake being always efficient. The service brake shoes is a contracting band 15 inches diameter and 2½ inches width, and the expanding internal brake shoes contact two inches width on the 14½ inches diameter drum.

The Pinion Shaft Housing.

The driving pinion or propeller shaft and the pinion are integral, of nickel steel, and the shaft is carried in a malleable iron housing that has a shouldered engagement in a recess and is bolted by six bolts to the forward side of the expanded centre of the axle beam. The shaft projects through the "eye" in the axle to engage with the bevel driving gear of the differential assembly. The shaft is mounted on two double row annular ball bearings of liberal size. The shaft is not adjustable after it is once fitted and cannot be displaced or changed. It is not possible to vary it from the original alignment. The outside bearing is retained by a collar, and between the collar and the cap, which is screwed on, there is a felt washer, that will prevent the leakage of lubricant. The outer end of the pinion shaft, to be fitted to the driving shaft, is finished to the standard S. A. E. dimensions.

But One Axle Adjustment.

The only adjustment that can be made in the axle, aside from the brakes, is the differential assembly, which can be varied by adjusting nuts. When once assembled, however, there is no necessity for adjustment. The pinion shaft, differential and internal gear housings are packed with grease, and aside from renewal of lubricant from time to time no attention need be given to the moving parts. Grease cups are fitted to the jackshaft housing to lubricate the bushings in which the driving shafts turn, between the retaining collars and the outboard bearings.

The dimensions of the 1500 and the 2000-pound load capacity axles are the same, save in the construction of the hubs, the latter having larger bearings and the spur pinions are nickel steel. The 3000 and 4000-pound axles are approximately the same, being constructed to one design, but with heavier components.

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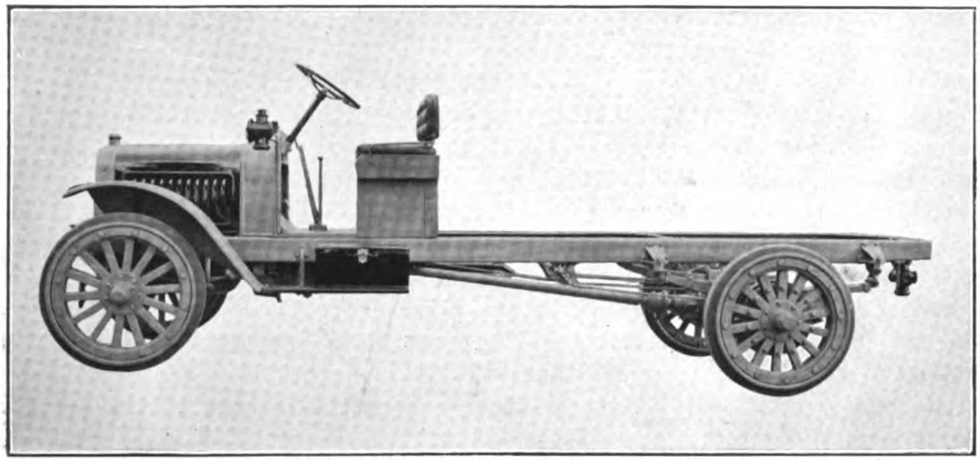
REPUBLIC TWO-TON INTERNAL GEAR DRIVEN TRUCK.

WITH the purpose of meeting the demands of a still greater market, the Republic Motor Truck Company, Alma, Mich., is now building a fourth type or size truck that is rated as 3000-4000 pounds capacity, this being the largest machine the concern has produced, and which may be regarded as being in the two-ton class. The first Republic truck was 3000 pounds load rating, and the second 2000 pounds, both of these being driven by chains. The third was 1500 pounds, and having met with all the requirements of those who can use light and fast machines, the company has now turned to the business classes who have use for vehicles of greater capacity.

The 1500-pound wagons are driven by an internal gear system of power transmission and the experience with these was so satisfactory that this drive was determined for the largest machine. The experimental work and the tests made with the 1500-pound Republic wagons covered a considerable period of time, and the results were such that the company became a member of the Internal Gear Drive Association, an organization formed for the purpose of educating the public to the advantages of this form of power transmission, and very logically the company continued the use of what has been amply proven to be thoroughly economical and practical. Or, to put it another way, the company was so convinced of the value of the internal gear drive from service experience, that it adopted it for the larger machine.



Side View of the Republic 3000-4000-Pound Capacity Chassis.

The 3000-4000 pound chassis is simplified throughout and is extremely accessible. The mechanism has been carefully protected against wear, all the moving parts, aside from the steering and braking linkage, being enclosed, and care has been taken to insure thorough lubrication. The construction has been made very heavy to endure wear and stresses of service, but the machine is relatively light because of the few number of parts. There are no radius rods, for instance, the driving and braking thrusts being taken by the forward ends of the rear springs, and the suspension of the frame between the rear springs means a low platform, greater ease in handling freight and lower centre of gravity, factors of considerable importance when bulky loads are carried.

Design Is Relatively Light.

The chassis is driven by a unit power plant of motor, clutch and transmission gearset, and power is transmitted to the jackshaft, combined with the rear axle, by a large tubular shaft. This minimizes mechanical construction, insures complete accessibility and lessens operating care and attention. The weight of the chassis is 3750 pounds, which is comparatively light.

The design is conventional throughout, the chassis being constructed of parts that have been perfected and standardized by manufacturers, which are known to be the development of long experience, and are produced by high-class facilities and by expert workers, in conditions that insure factory perfect construction. The different components have been harmonized to obtain a dependable and well balanced machine, with generous factors of safety.

Motor a Continental Model.

The motor is a Continental model N, which has bore of 3¾ inches and stroke of five inches, rated at 22.5 horsepower by the S. A. E. formula. The claim is made that this engine will develop 30 horsepower at maximum speed. This motor is a four-cylinder, four-cycle, water cooled, L head, vertical type, with the cylinders cast en bloc with the valves at the right side. The cylinder block is cast with the water jacket head open, and the chamber is closed by a large channelled cover plate retained by cap screws. The water outlet manifold is centred in this plate. The block is webbed to form pockets beneath the valves to fully enclose the valve stems and tappets.

The crankcase is a barrel type with a central transverse web for the centre main bearing, and forward end being extended to house the timing gears and the rear end being formed as a bell to cover the upper half of the flywheel and carry the two side supporting arms. The base of the crankcase is a pressed steel oil pan that may be easily removed to give access to the main and connecting rod bearings. The crankshaft bearings from front to rear are 2 3/16, 2 7/32 and 2¼ inches diameter respectively, and in the same order the lengths are 2 9/32, 2½ and three inches. The flywheel flange is forged integral with the shaft. The camshaft forward bearing is 2⅝ inches diameter and

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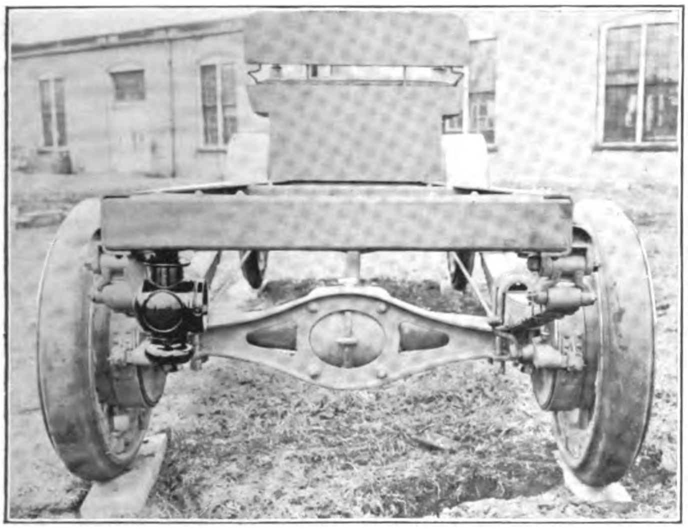


The Rear Construction of the Republic 3000-4000-Pound Truck, Showing the Celfor Internal Gear Drive Axle.

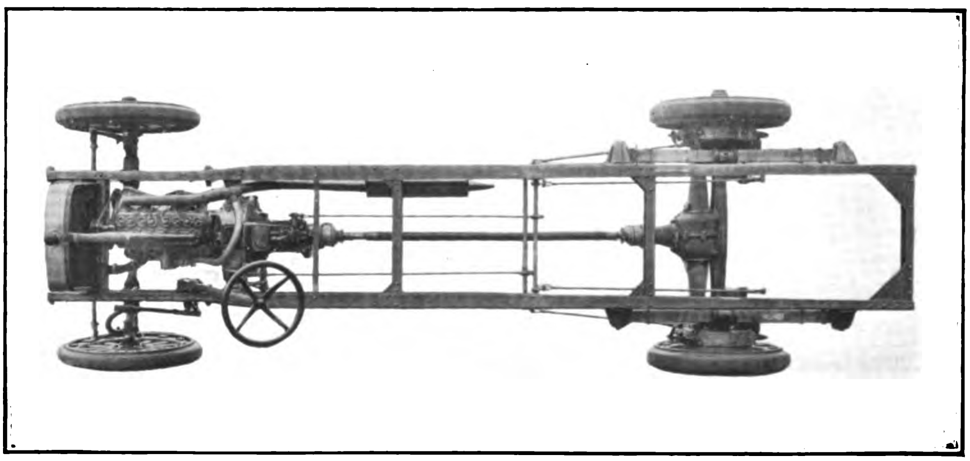
1 7/16 inches length, and the rear bearing is 1¼ inches diameter and 1¾ inches length. The pistons are four inches length and are fitted with three rings.

Details of Engine Construction.

The crankshaft is carried in babbitt bearings in bronze shells. The big end babbitt bearings of the connecting rods are 1⅞ inches diameter and 2 3/32 inches length. The bearings are fitted with steel shims and practically any adjustment can be made. The chrome nickel wristpins are fixed in the piston bosses and the small ends of the connecting rods are bushed with phosphor bronze. The timing gear assembly is housed in a case designed to afford full lubrication. The valve ports are of liberal proportions and the valves are nickel steel heads welded to carbon steel stems. The valve seats, valves and valve stems are ground accurately to size. The stem ends are hardened to minimize wear from the tappets and the tappets have the usual screw and nut adjustment.

The motor is lubricated by a combination force feed and splash system, the oil being drawn from the reservoir through an outside filter, and after filtration is forced to the timing gearset, the overflow draining to the base of the engine case, where it is distributed by splash to all the internal moving parts and bearings. The volume of oil in the reservoir is shown by a float operated gauge.

The motor is cooled by a thermo-syphon circulation of water through the cylinder jackets and the vertical round tube radiator of large capacity, radiation being increased by an adjustable bracket mounted on the forward end of the cylinder block that is driven by a flat belt from a pulley on an extension of the camshaft. This system is said to be extremely efficient in all operating conditions. The carburetor is an automatic float feed type that has a hot air jacket from the exhaust manifold, and the ignition current is supplied by a high-tension magneto with fixed spark. The motor is equipped with a governor that is controlled by the velocity of the fuel gas supplied from the carburetor, and this can be adjusted to any limitation of speed desired.



Top View of the Republic 3000-4000-Pound Chassis Without Hood, Dash, Driver's Seat or Mudguards.

Clutch, Gearset and Driving System.

The transmission gearset is a Fuller & Sons Manufacturing Company's construction that is combined with a multiple disc clutch. The clutch is large and has eight discs that have 14 contacting faces of alternating steel and Raybestos. It is operated without lubrication of the discs and is claimed to be extremely efficient and easy of engagement. The gearset is a selective sliding gear type with three forward speed ratios and reverse, with shafts and gears of nickel steel, heat treated. The gears have ⅞-inch faces. The shafts are mounted on Fafnir annular ball bearings. The gear ratios are: Low, 22:1; intermediate, 13:1; direct, 8:1, and reverse, 28:1. The purchaser has the option of a direct gear ratio of 9:1.

The power plant is mounted on three points and is fully protected against the stresses of chassis distortion. The main shaft of the gearset is coupled to the driving shaft by a universal joint, the forward end of the driving shaft being supported by a bracket carried on a frame cross member. The shaft is a tube 2½ inches diameter with walls 3/16 inches thick, and the coupling to the forward universal is telescopic to insure against end thrust. The rear universal couples the main shaft to the pinon shaft that is incorporated in the Celfor rear axle.

Internal Driven Rear Axle.

The rear axle is designed for driving internal gears on the wheels, and it is primarily a drop forged steel I beam, two inches width, that is increased to 12⅜ inches depth in the centre, where it is skeletonized through a web a half inch in thickness. This construction is practically a truss, having great strength to resist a load and yet being light weight. The wheel spindles are on the ends of the I beam and inside the

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spindles are the spring seats and the flanges that support the brake spiders, which also serve as covers for the internal gear housings. The jackshaft is enclosed in a case, the central section containing the pinion shaft, master gear and differential gearset, and the driving shafts are carried through tubes, the outboard ends of which are mounted in the brake spiders. The central section of the jackshaft is bolted to the I beam by four heavy bolts.

The axle shafts and the differential are mounted on Hyatt roller bearings and the pinion shaft is carried on double row annular ball bearings, and is fitted with a ball thrust bearing. The spur pinions on the ends of the driving shafts mesh with the internal gears that are mounted within the wheel drums. The spur pinions are four pitch and 1½ inches face, and afford a 4:1 reduction. The bevel gear reduction is 2:1. The construction is such that the jackshaft and the internal gears are fully housed and thoroughly lubricated. The 3½ per cent. nickel steel wheel spindles are fitted with Bower ball roller bearings.

Other Features of Construction.

The pressed steel channel section frame is 202 inches length, 34 inches width the greater part of the length and "necked" to 31 inches width between the wheels. It is 5¾ inches depth at the centre, with webs 3⅝ inches width, and quarter-inch material. This is carried on semi-elliptic springs of heat treated alloy steel, the forward set being 38½ inches length and 2¼ inches width, and the rear springs 52 inches length and three inches width. The forward springs have eight leaves and the rear springs 12. All are shackled at the rear and are amply lubricated. The forward axle is a Timken I section, two inches width, 2½ inches depth, with web a half-inch thick. The wheel spindles are fitted with Timken roller bearings. The wheels are artillery type, with 14 two-inch spokes, fitted with 35 by four-inch solid band, demountable tires forward and 35 by five-inch tires rear. The purchaser has the option at additional cost of 35 by 3½-inch dual rear tires.

The steering gear is an irreversible type at the left side and the linkage is heavy and is adjustable for wear. The control is by the usual foot pedals and hand throttle lever, with the gear shifting and the emergency brake levers in the centre of the footboard. The service brake is double-acting, with thermoid lined bands contracting on the rear wheel drums, 16½ inches diameter and three-inch face, and the internal expanding emergency brake shoes operate in drums 16 inches diameter and 2¼ inches face. The gasoline tank under the driver's seat has 16 gallons capacity. The chassis equipment includes a driver's seat and cushion, front fenders, running boards, oil dash and tail lamps, tool box, tool kit and horn. The price is $1575.

The Arhelger Truck Company of Milwaukee has placed on the market steel trailer trucks of from 1000 to 1500 pounds.

SPECIAL TRUCK TAXES UNJUST.

The proposals made in many states to enact special taxes for motor trucks to make up for damage which especially heavy vehicles are supposed to cause to the highways is discussed in a suggestive way by R. W. Hutchinson, Jr., a well known truck engineer and traffic expert.

Much of the proposed legislation ignores the most important fact regarding truck traffic, that one truck may replace six or seven horse drawn vehicles. The comparison of the highway wear caused by a motor truck and one horse drawn vehicle is unjust. Damage caused by one truck should be compared with that done by several horse drawn vehicles, in his opinion.

For the same reasons the truck multiplies the usefulness of the streets, as one truck or tractor with trailers that occupies 35 or 40 feet of highway space may do the work of 10 to 15 teams with a maximum overall length many times greater. Every one of the few 26,000 to 36,000-pound vehicles in use in New York has made available for the use of other vehicles eight to 10 times as much street space as the machine itself occupies.

DISPOSAL OF MILITARY TRUCKS.

Ernst Berge, head of the Daimler-Motoren-Gesellschaft, builder of Mercedes cars and trucks, is authority for the statement that the German government has already perfected plans by which, after the war, the great number of used military trucks will not be sold so as to demoralize the motor vehicle market.

The trucks will be divided into three classes, those in good condition, those in need of repair and those that are worn out. The first will be kept by the army, the second will be turned over to a company made up of motor manufacturers which will repair them and sell them gradually at no profit to themselves, and the third will be scrapped.

The Morton Truck and Tractor Company of Harrisburg, Penn., has taken over a factory at York, Penn., in which it is to produce tractors, trucks and armored cars to the value of $1,200,000. The Wichita Falls Motor Company of Witchita Falls, Tex., is said to have shipped recently a number of trucks on an order for 300 recently received from Europe.

The Motor Truck Association of Philadelphia at a recent meeting took up the subject of good roads and decided to throw its political influence to legislators who are favorable to road improvement.

The Chicago section of the Electric Vehicle Association recently devoted a session to the discussion of industrial trucks. The Buda and Mercury industrial trucks were explained and discussed.

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ELECTRIC VEHICLE PRACTISE.

Differing Types of Ampere-Hour Meters, the Characteristics of These Instruments with Reference to Records, the Methods of Operation and Regulation and the Varying Values of the Readings.

By William W. Scott.

STATEMENT has been made that the lead-acid battery will lose capacity from two causes—the internal discharge following charging, and when discharged rapidly—so that measured indications are not always certain. The current used to charge a battery

Auto Type Sangamo Ampere-Hour Meter with Circular Dial and Hand for Special Indication.

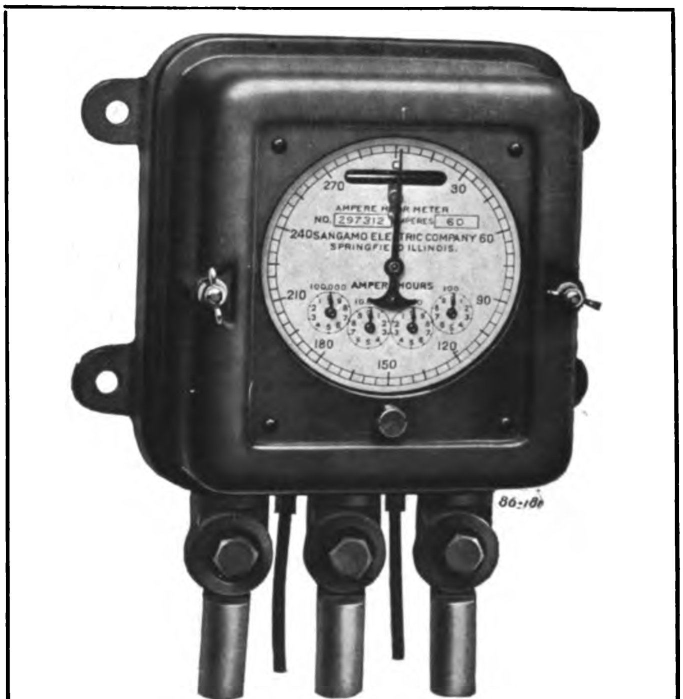
will be definitely known, but there is considerable variation as to the percentage that can be obtained because there are differing variables that have from time to time been referred to.

This loss has the effect of putting the ampere-hour meter "out of step" with the battery, so that the indication given is not true—that is, the instrument would show the battery to have more ampere hours of current than were really available for useful work. This has been the cause of criticism of the quality of the instruments, especially where lead batteries have been used, and was noticeable because of the accuracy of the meters. The reason, however, was that the user of the electric vehicle desired to learn how much battery capacity was at any time available rather than how much current he had used to a given time.

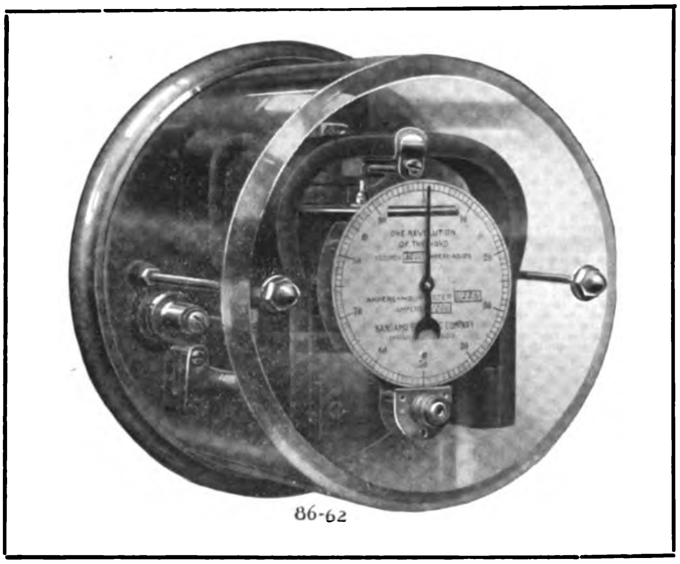
To meet this requirement the Sangamo ampere-hour meter has been developed so that it is compensated for the loss of useful current or capacity because of rapid discharge, and this type of instrument will at all times indicate the charge remaining in the battery and which may be drawn upon for work. This compensator consists of an electro-magnet that is shunted magnetically across the poles of the motor field magnet, its windings being in series with the discharge circuit. The current through the exciting winding increases the magnetic flux through the motor element, thus increasing the speed of the meter with the increased use of the current according to a definite and predetermined characteristic. Because of this construction, under very high discharge rates, the meter will register not only the ampere hours used, but also those lost from excessive current or discharge rates. This compensator can be used with any ampere-hour meter.

With reference to characteristics of the compensator stated, these apply directly to the lead-acid battery, but as applied to the Edison batteries the condition differs, for while Edison cells do not evidence diminution of ampere-hour capacity with rapid discharge there is a distinct fall of voltage, so that from the viewpoint of the user the result is the same as though the amperage were reduced. The reader should understand that there cannot be an indication by the instrument of the variance in voltage, so that with Edison cells the readings are usually of the true ampere-hours capacity available.

The usual switchboard equipment in the charging



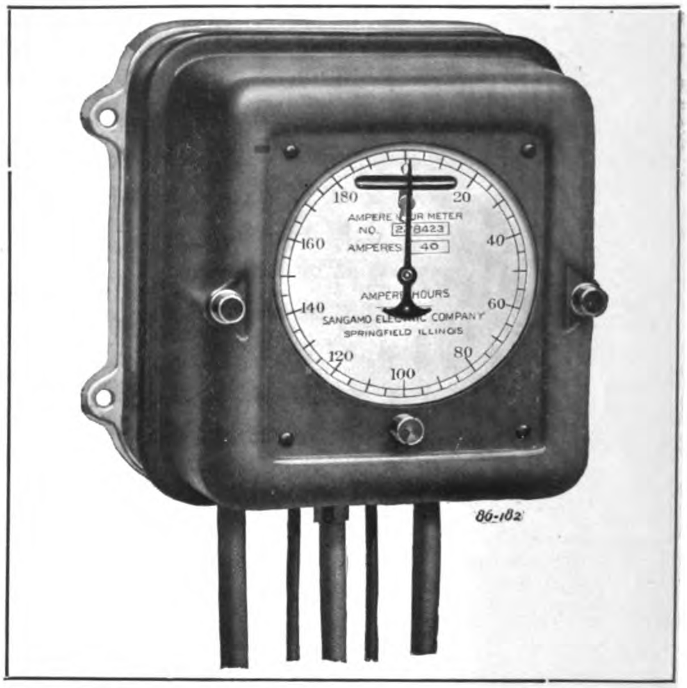
Service Type Sangamo Ampere-Hour Meter with Totalising Dials.



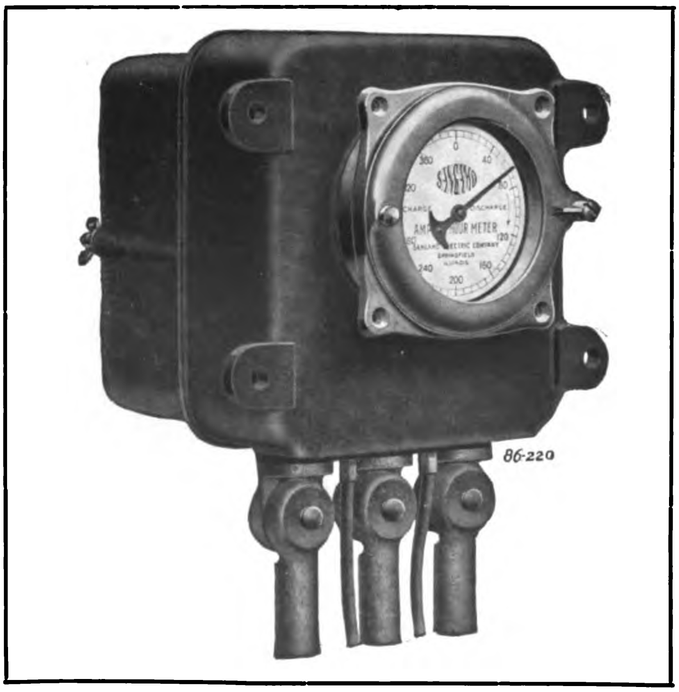
Switchboard Type Sangamo Ampere-Hour Meter with Circular Dial Enclosed in Glass.

station or garage consists of the voltmeter and ammeter, generally separate instruments, although in some instances the duplex type may be used. With these the condition of the battery with reference to voltage and amperage can be ascertained at the beginning of and during the continuance of a charge, and in connection with the use of these tests of specific gravity can be made whenever desired. These, however, do not indicate the quantity of current necessary for charging, and if this information is desirable, when accurate information as to current cost is required to determine operating expense, this is obtainable by the installation of watt meters. Current is sold on the basis of watts, the price usually being with kilowatt-hours as the unit, and with the quantity supplied to each vehicle, which may be desired by some owners, measured by a watt meter, current expense for each machine can be accurately obtained. In any event the current, if supplied by a public service company, is measured by a watt meter. The cost of installing watt meters for each vehicle in service may be regarded as unnecessary expense, for these instruments are not essential to vehicle operation, they merely supplying detail relative to each machine.

The use of the ampere-hour meter is for an entirely different purpose because these are installed in the vehicles and indicate the number of ampere-hours of current charged and discharged. The ampere-hour meter, as stated, will register the true number of ampere-hours current that is charged and will record all of the current that is passed through it for the operation of the motor in driving, less the internal discharge or loss for other reasons. These indications are thoroughly dependable, and with the compensator the reduction of capacity from rapid discharge is obtainable.



Sangamo Ampere-Hour Meter in Aluminum Case, with Bottom Connected Cables.



Sangamo Service Type Ampere-Hour Meter with Extension Dial for Dashboard Mounting.

The owner or operator of the electric wagon or truck expects a given work from the machine, and when time is required for charging or boosting, and current expense is to be minimized, good judgment impels the utilization of the vehicles to the greatest mileage that is practical. Battery voltage can be reduced to mileage by computation, and this may be corrected with reference to other influencing factors, but these cannot be learned at a glance and the possibilities of a battery so far as useful work is concerned can only be accurately determined by knowledge of the ampere-hours of current not discharged and available for use.

With the compensated instrument the driver or the person directing service can read the indication and with knowledge of the average mileage current consumption (a factor that can be obtained by taking readings of the ampere-hour meter and the odometer and dividing the number of ampere-hours used for routes or trips by the miles driven) he can always de-

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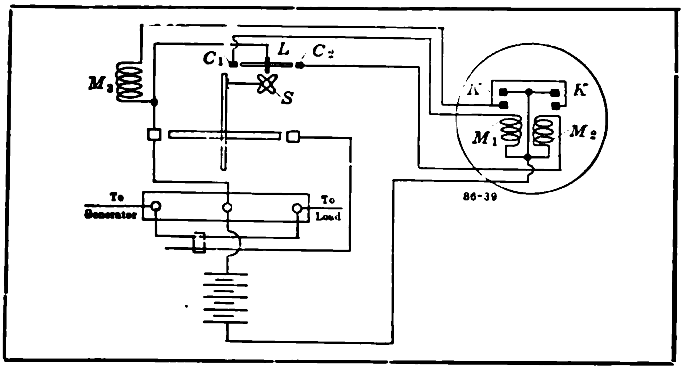


Circuit Diagram of Distant Dial Connected with a Differential Shunt Ampere-Hour Meter.

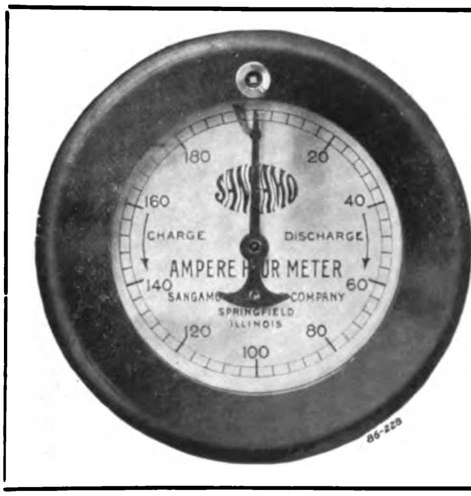
termine what may be practically done, and whether boosting or substitution of another vehicle is necessary before dispatching a machine from the base of operation. With this information, as well, the driver can determine at any time whether or not the battery charge is being normally or abnormally consumed, if there is need of boosting or charging to do the work required, if there is need of attention to restore vehicle efficiency, and to obtain other data that will be decidedly valuable in operating the machine. Another very necessary factor is the variance in current needed for work because of difference in road conditions, as between, for instance, dry and wet surfaces, in rain, sleet, snow or in muddy highways. The current requirements with reference to changes in highways affecting traction are considerable, and when batteries are closely operated to capacity more precise and satisfactory results can be obtained with this data, the importance of which is not generally realized or understood.

While there is no reason why electric vehicles should be operated at high discharge rates, save in the event of emergency, statement should be made that the differential shunt or variable resistor ampere-hour meters are not adapted for service where there is need of charging at comparatively low rates and discharging at high rates, or vice versa. When the service is such that an instrument of this character is required a type has been perfected that has a special recording train controlled by an electro-magnet that is excited through a circuit, controlled by contacts on the switch used to throw the battery from charge to discharge. This magnet operates a switch that shifts the gears between the meter shaft and the recording train from one ratio of transmission to another. In this the ratios may be varied to meet different conditions of use. That the same dial may be used for both charge and discharge, the shunt is automatically changed simultaneously with the gears, the value being chosen to allow for overcharge, as with the differential and variable resistor ampere-hour meters.

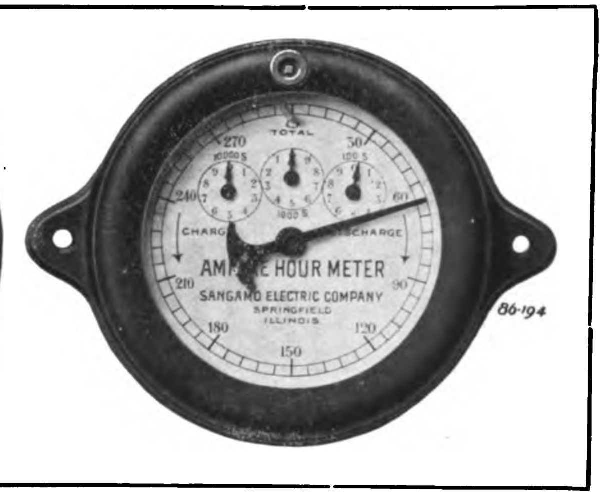
The dials, from which the readings of the instruments are taken, are of types to meet the needs of the particular services for which they are used. The circular dial is the most general and it is adapted to use where the instantaneous condition of the battery is all important. These are made to indicate any desired number of ampere hours for each revolution of the pointer or hand, from 100 to 600 to the revolution. Much importance is attached to having the dial so calibrated that the maximum possible discharge of the battery is considerably less than the number of ampere-hours indicated by one revolution of the dial pointer.

When a record of the total quantity of current either used for or supplied from the battery is desirable, for checking operating expense, for instance, totalizing dials may be supplied. These have a separate and distinct function from that of the standard circular dial, and as they are driven through a ratchet they will record only when the current is in one direction, either charge or discharge, but not both. The designation of duplex dials as applied to ampere-hour meters is different than with the voltmeter or ammeter, as these are intended to keep record of both charge and discharge.

With the duplex type there are two rows of recording dials, the upper recording the total discharge and the lower the total charge. The reading of total charge divided by the total discharge will give the average ampere-hour efficiency of the battery. These, however, are not used for electric vehicle service, save in a station. The charge of the battery is not directly indicated, but can be determined by subtracting the readings of the discharge dials from those of the charge dials. For electric vehicle service, by gearing the train with a ratio suitable to the charging voltage, these dials may be so arranged that the charge dials record the energy input in kilowatt-hours. With such a meter the cost of energy input in kilowatt-hours is computed from the charge dials, while the ampere-



Sangamo Distant Dial, Flush Type, Recording Charge and Discharge Only.



Sangamo Distant Dial, Projecting Type, Recording the Total Discharge of the Battery.

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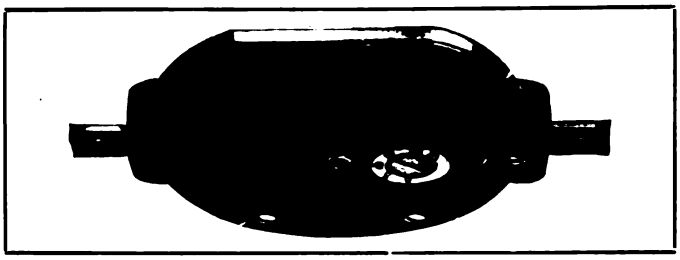


Bottom of Sangamo Resistor Element, Showing the Adjusting Device to Afford Overcharge to 25 Per Cent.

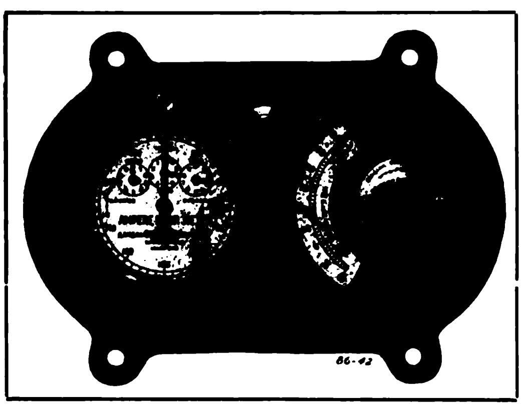
hour output is read directly from the discharge dials.

Location of instruments where reading of the dials would be inconvenient, if not impractical, brought about connection with dials apart from them, and these are known as the distant dial types. In these the recording mechanism has been replaced by a contact-making device that closes an electric circuit each time that a given number of ampere-hours have passed through the meter, and these current impulses are recorded on a distant dial.

An accompanying diagram illustrates the current action in such an instrument. In this the star wheel S is rotated by the meter shaft and engages the slide bar L, closing the contact with either C1 or C2 against the pressure of a spring. Closing a circuit through C1 or C2 energizes the magnets M1 or M2, respectively, which are included in the distant recording device. These magnets operate a ratchet that turns the dial hand to right or left, depending on which magnet is in action. The operation of the ratchet by either magnet closes the contacts K and this energizes the trip magnet M3, in the meter proper, that trips the bar L.

Should for any reason the wires to the distant device be broken so that the trip magnet will not operate, the star wheel will continue to turn because of the influence of the meter torque, compressing the spring on the slide bar until it slips past and allows the bar to return to the neutral position. This distant dial mechanism is used with either plain circular dials or totalizing dials, and the resetting device is applicable to these as well as to other dials.

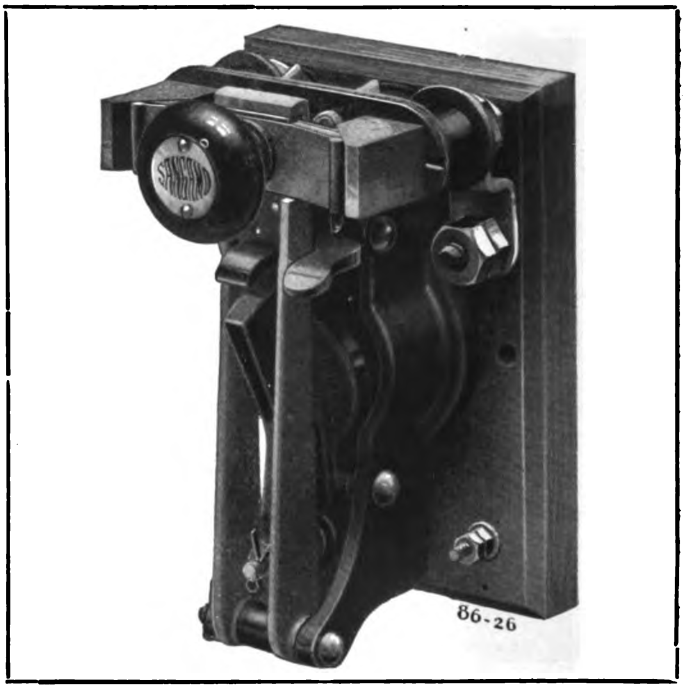
For the service of those who desire to operate batteries in extreme economy, as with vehicle operation, an ammeter is incorporated in the same case with the distant dial of the ampere-hour meter. The ampere-hour meter indicates the state of charge of the battery, while the ammeter shows the instantaneous current or rate of flow into or out of the battery.



Combination or Duplex Ampere-Hour Meter and Ammeter, Which Will Show Battery Charge or Discharge and Instantaneous Current Flow.

All Sangamo ampere-hour meters are enclosed in dust proof cases. The switchboard type is round and adapted for attaching to a switchboard, and those intended for vehicle service are designated the back-connected or auto type, the front-connected or service type, and the extension front type, the last mentioned being intended for mounting in a dash or where it will be accessible for view and so located that it may not be damaged by ordinary use. The distant dial instruments are supplied with four types of cases, these being the flush, projecting, semi-flush and projecting combination, the last two being combined with ammeters. The combination meters are often used for pleasure cars.

The customary use of the ampere-hour meter with electric vehicles in charging is in combination with the switchboard instruments, because the meter does not record voltage or amperage, but it may be utilized in charging to excellent advantage, for it will register very accurately. The standard service instrument has a point on the dial indicated as zero, and the pointer or hand moves from this clockwise, when discharging, and in reverse of this direction when charging.



Sangamo Circuit Breaker, Designed for Use with Sangamo Ampere-Hour Meters.

Some types of meters are made in which this hand movement is counter-clockwise when discharging and in reverse of this movement when charging. The dial that registers discharge by a clockwise movement always indicates the exact condition of the battery with reference to the number of available ampere-hours of current, and the zero contact device for stopping the charging can be used. With this type of dial and movement the hand registers progressively as the current is used, and the operator of the vehicle, knowing the capacity of the battery (if fully charged), or the value of the charge given, determines the power avail-

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able for any useful work from the battery.

When the movement on the dial is counter-clockwise in charging and clockwise in discharging, there is a direct reading of the condition of the battery charge by ampere-hours at all times (for the dial reading is made clockwise), but the meter cannot be fitted with the zero contact.

The zero point is at the top of the circumference of the dial, and the movement of the hand is read with reference to this, for the hand can only be at zero when the battery is fully charged. As the battery is discharged the hand will move from this point and the reading of the clockwise dial scale will indicate the total number of ampere-hours taken from the battery since it was charged. If, for instance, the battery was charged with 225 ampere-hours and the meter will show a discharge of 135, there must be approximately 90 ampere-hours current available. If the meter is not compensated it will not show the loss of the battery capacity, with reference to the charge, from internal discharge and other causes, but will indicate the exact number of ampere-hours used for useful work. If the instrument is compensated the reading will account for the loss.

Some instruments are fitted with movable hands attached to the glass covering the dials, which can be placed in any position by turning a milled nut above the glass. Such hands can be set to indicate what may be regarded as a safe discharge limit, or the value of the charge being used at the time may be indicated. The hand can be adjusted as the operating efficiency of the battery changes, for charging is obviously dependent upon variable conditions that influence the battery.

The simple shunt ampere-hour meter will indicate true charge or discharge. It will not indicate capacity loss in discharging, and when charging the hand must be set at whatever point is desired, as there must be allowance for a greater input than output of energy, the percentage of the overcharge being judged by the person doing the charging. The use of these instruments requires observation and knowledge of the battery, as well as consideration of factors immediately influencing it, such as temperature, condition of previous charge and rate of discharge.

With the differential shunt type meter the percentage of charging is varied by the use of the slider, and the variance may be from 10 to 30 per cent. For normal operating conditions the meter is set from 10 to 15 per cent. slow for lead-acid cells, and from 15 to 25 per cent. slow for Edison cells. Setting slow may best be illustrated as follows: If the battery has, for instance, a capacity of 40 ampere-hours discharge at a five-hour rate, the total capacity would be 200 ampere-hours, and if it were charged at the rate of 40 amperes an hour for six hours, this would be 20 per cent. slow. That is, 20 per cent. more charge would be given than had been discharged. The differential shunt meter can be set to a given percentage for charging and reset whenever peroidic overcharge is required.

The resetting device with meters not equipped with other means of adjustment, is a stud that projects from the case of the instrument, which carries a clutch that can be operated by inserting a square shanked key and pressing down until it grips a gear connecting with the pointer shaft, by which the pointer can be turned to any desired position. With this device the simple shunt meter can be used as a direct indicator of the state of charge of a battery, and it may also be used for putting the meter into step with the battery, no matter what the cause of the non-coincidence may be. Resetting will adjust it to the condition existing at any given time. Obvious, it may be used to give the periodic overcharge that is necessary.

The variable resistor element previously described can be used only with meters that are not of the differential shunt or the duplex types, but can be fitted to all Sangamo meters of other design intended for auto, service or switchboard use. This is recommended where there is need of giving an automatic overcharge. The design of the resistor element is such that any desired percentage of overcharge can be given by setting an adjusting screw in the bottom of the element to show the required percentage on the scale. All meters with the resistor element are regularly designed to read true ampere-hours discharge for any setting of the resistor element, and, therefore, run slow on charge by a percentage dependent upon the setting of the adjustment. The statement is made that the meter with the resistor element is suited for use with any storage battery save when there is desire to record only charge or discharge, in which case the standard simple shunt meter, without resistor, is recommended.

In the event of a partial or freshening charge being necessary, the meter is set for the value of the current desired and the charging is continued until the dial hand has reached the zero mark.

The zero contact device is especially desirable where batteries are charged unattended, or where comparatively little attention is given. With this device the meter is set for the required charge and when the dial hand has reached the zero mark it will make contact and the circuit breaker will terminate the charge. The circuit breaker is operated by the meter itself and it is thoroughly automatic. It is not governed by voltage or amperage, for only when the required number of ampere-hours current have been indicated will it operate. The Sangamo shunt trip circuit breaker is designed for use with these instruments and is a special construction that is designed to have long endurance. Claim is made that it will operate satisfactorily in any position, and that the contacts will carry current continuously up to 150 amperes.

(To Be Continued.)

Herbert H. Rice has succeeded William B. Cooley as president of the Waverly company of Indianapolis. Wilbur C. Johnson has been promoted to the vice presidency.

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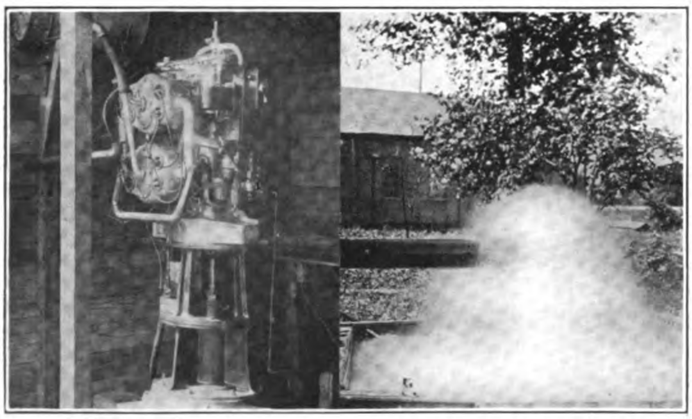
ENGINE RUNS ON END.

High Efficiency of Oiling System of a Stock Wisconsin Motor.

A remarkable use is made of a gasoline motor built for vehicle propulsion by the Wisconsin Motor Manufacturing Company, that is now driving a water pump 10 hours daily, and in this service the machine is operated with the cylinders horizontal instead of vertical. That an engine could be successfully utilized in such a condition is surprising, but the accompanying illustrations will demonstrate the installation and the results obtained.

This machine is a stock model A-U Wisconsin motor, with cylinder bore of 4¾ inches and stroke of 5½ inches, which has an S. A. E. rating of 36.1 horsepower, but which will deliver a much greater power when operated to maximum capacity. It is used to drive a direct connected centrifugal water pump that delivers 750 gallons of water a minute. The illustrations show the engine as it is set up in the power house and the flow of water that is delivered from the pump outlet.



Model U-4—Wisconsin Motor Mounted on End to Drive a Centrifugal Water Pump, and the Water Outlet Delivering 750 Gallons a Minute.

Were the motor set in the position in which it was designed to be operated it would be lubricated by oil drawn from a reservoir in its base, but as the pump connection could not be made with this installation, it was set on its rear end on a specially constructed standard which surrounds the pump shaft, and which is firmly bolted to a bed. A special oil tank was constructed and placed under the engine and the lubricating pump connected with a line to the base of the reservoir. From this the oil is pumped and the main bearings are flooded, the excess being forced through the hollow crankshaft to the connecting rod bearings. The oil is forced from the connecting rod bearings and is distributed by centrifugal force to all of the moving and reciprocating parts, and the drainage is carried through a screen and then back to the reservoir.

The engine appears to operate as efficiently on end as it would when on a base, and so far as can be determined from the period it has been in use it is as productive of power as though normally operated. When the motor is started it is cranked in the usual manner with the starting handle by a man standing on the platform seen at the right side of the engine. As will be noted, the only change made is in the installation of the carburetor, which must of necessity coincide with the position of the motor. The motor is cooled by water from the tank above it at the left side, and the exhaust is direct into a pipe extended through the side of the structure.

CARY'S TROUBLES IN EUROPE.

C. P. Cary of the Federal Motor Truck Company was sent to Europe some months ago with a sample Federal truck in an effort to get business for the company. The truck caused him all kinds of trouble.

At the time he was trying to get it shipped from France to England, one after another of the channel boats were taken over for the government service. He booked passage for the truck several times only to see the boat on which it was to sail confiscated.

Finally he secured passage for it on a government boat and when he arrived in France, that the truck was on the boat, was taken as evidence that it was government property. About six days' explaining were necessary before it was turned over to him and he was allowed to put it on the road and set off for Paris.

He was stopped, inspected and searched every mile or two on the way, but finally got the truck to Paris in good condition. Mr. Cary will remain in Europe for the company for some time.

GREEK GOVERNMENT OWES $13,000.

The Knox Motors Company of Springfield, Mass., has been trying unsuccessfully to collect $13,000 due it as a balance on the sale of five of its three-wheel tractors which were delivered last fall to the Greek government. The tractors were ordered by the Greek charge d'affairs in Washington, D. C., who paid $1000 down on them. He was shortly afterwards recalled and the shipment of the tractors ordered by another representative of the Greek government. The balance due on them has not been paid.

WANT REDUCED FERRY RATES.

Motor trucking interests of New Jersey, represented in the New Jersey Motor Truck Club, met recently in Newark and inaugurated a movement to secure cheaper ferry rates on the Hudson river ferries. They took up the subject of good roads with a declaration that they could get only 5000 miles from a set of tires while in Connecticut, and some other states a mileage of 9000 was not uncommon. The loss in mileage was attributed to the poor New Jersey roads.

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S. A. E. SUMMER MEETING.

Standardization of Material and Constructional Detail Discussed.

The mid-summer meeting of the Society of Automobile Engineers, which took place on the steamer Noronic, with two trips on the steamer Waubic, on Lake Huron, June 14-17, inclusive, was extremely well attended and thoroughly enjoyed, while the sessions were decidedly profitable. Included in the business transacted at the meetings, which took place in the saloon of the big steamer, was an address by President W. H. VanDervoort, the reports of the treasurer and the membership committee and the election of a nominating committee. The society has added 105 to its membership since the mid-winter session, and the nominations for the annual meeting will be made by a committee consisting of H. G. McComb of the General Vehicle Company, K. W. Kimmerschied of the General Motors Company, Howard Marmon of the Nordyke & Marmon Company, B. B. Bachman of the Autocar Company, Henry Souther of the Ferro Foundry and Machine Company, David Fergusson of the Pierce-Arrow Motor Car Company and J. G. Perrin of the Continental Motor Manufacturing Company.

The plans for the year comprehend a one-day meeting and a banquet during the New York automobile show, which will be preceded by a meeting of the standards committee the day before the association shall meet. This will minimize the time and will impel a larger attendance.

The activities included two professional sessions the afternoon and evening of the first day, one session and a meeting of the standards committee the morning and afternoon of the second day, a session the evening of the third day, and reports of the standards committee the morning of the fourth day.

More time was devoted to subjects relating directly to trucks than at previous meetings, and these were of special interest, while the standards considered were to a considerable extent as applicable to trucks as to pleasure cars.

The papers included the following subjects: "Automobile Clutches," W. F. Herst; "A Formula for the Comparison of Automobile Performance," C. T. Myers; "A Scientific Method of Testing Electric Vehicles," T. H. Schoepf; "Farm Tractors and Their Motors," Philip S. Rose; "Road Tractors," Frank H. Trego; "Increasing Truck Efficiency with Trailers," A. R. Miller; "Automobile Lubrication," C. W. Stratford; "Size and Inflation of Pneumatic Tires," P. W. Litchfield; "Spiral Bevel Gears for Automobile Drives," A. L. Stewart; "Pressed Steel Wheels for Pleasure Cars," Orrel A. Parker; "Spring Design," C. H. Gleason; "Aeroplane Engines," Neil MacCoull; "A Type of Truck for Military Use," Jerry W. Decou; "Aluminum Pistons," Eugene Gruenewald; "Motor Fire Apparatus," Joseph A. Anglada.

Besides the meeting of the standards committee, the following division reports were made: Carburetor Fittings, by J. A. Aull; Electrical Equipment, A. L. Riker; Electric Vehicle, A. J. Slade; Iron and Steel, K. W. Zimmerschied; Miscellaneous, J. G. Utz; Springs, C. W. McKinley, and statements of progress were made for the Ball and Roller Bearings, Chains, International Standards, Research and Truck Standards divisions by the chairmen.

ELECTRIC VEHICLE SERVICE.

During the annual meeting of the National Electric Light Association at San Francisco, June 8-11, a considerable part of one session was given over to the presentation of a lengthy paper prepared jointly by John F. Gilchrist and A. Jackson Marshall, respectively president and secretary of the Electric Vehicle Association of America, the paper being read by Mr. Marshall, which was devoted to a consideration of the value of electric vehicle use promotion by central stations. In this differing comparisons were made with other methods of selling electric current, and the results from the use of electric vehicles by the central stations were emphasized as being definite and certain.

The possibilities from concerted endeavor by the public service corporations were summarized, and the necessities of co-operation of the light and power companies with the vehicle builders were pointed out. The actual utility of the electric automobile as compared with other types for city haulage and use was dwelt upon to considerable length.

A paper by William P. Kennedy, a well known consulting engineer of New York City, upon accounting methods for electric vehicle operation, was read by Mr. Marshall, and discussed by Day Baker of Boston, New England manager for the General Vehicle Company.

GOODYEAR OFFER CONTINUED.

The Goodyear Tire and Rubber Company will, through the months of July, August and September, continue the offer to refund to any purchaser the price of Goodyear S-V tires if they fail to prove superior to competing tires on a basis of cost a mile. The offer was originally made to continue through April, May and June, and in substance is that where two opposite wheels are equipped at the same time with one Goodyear S-V and another make shoe of like rated size, bought in open market, should the cost of the S-V tire prove more than the other the full purchase price will be refunded.

The Indiana section of the S. A. E. has adopted a new constitution that will allow an expansion of membership by affiliation, and a campaign is to be begun to increase the numerical strength of the organization. Any one directly connected with the automobile industry is eligible.

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TIFFIN STREET FLUSHER.

Motor Driven Pressure Tank Apparatus of Exceptional Efficiency.

A municipal service apparatus that has exceptional efficiency, and which may be used for a wide range of work, is the equipment produced by the Tiffin Wagon Works, Tiffin, O., and which is affording an unusual degree of satisfaction and economy in a number of municipalities. The uses that may be made of the machine are numerous and include street watering by gravity head of pressure, and flushing paving, these works being those for which it was designed.

The apparatus consists of a 3½-ton Tiffin truck chassis on which is installed a steel tank with a capacity of 900 gallons, and to insure uniform distribution of water at any vehicle speed there is a separate pumping plant, which is used whenever occasion requires. This design insures a good working pressure in the tank if the machine is driven very slowly without operating the main power plant to greater speed than is necessary to move the chassis and its load, and necessarily reduces the consumption of fuel, for the pump need only be used when actual watering or flushing When the sprinkling is done by gravity the pump is not in use.

Tiffin Power Pressure Street Flushing Equipment on a Special 3½-Ton Chassis, Built Purposely for Municipal Service.

At the rear of the chassis is installed the water pump motor. This is a four-cylinder water cooled type with separate cooling and ignition systems, and the fuel is taken from the main tank. The pump is a centrifugal type that will afford a maximum pressure of 60 pounds in the pipe line. Between the water pump and the motor that drives it is a flexible coupling, and two flushing nozzles are mounted on ball and socket joints at the front of the chassis, so that the nozzles can be set for any desired angle, and both can be operated in one direction. The streams of water are constantly in view of the driver and he can observe the exact results and make adjustments to serve any requirement.

With the maximum pressure the range of the nozzles is much more than the width of the average street, so that with one passage of the machine through a boulevard the work can be done at a saving of practically half the time, and a paved street can be flushed with sufficient power to thoroughly clean it, which would not be possible with any other form of apparatus. Normally the tank is filled from hydrants, but it may be replenished from a river or lake or cistern by operating the pump. Thus water can be obtained from the most economical supply. In going to and from sources of supply time can be economized. If desired, gravity discharge is practical, but this will not afford the uniform distribution that is obtained with the use of the pump.

The chassis is built purposely for the work and it has a Continental four-cylinder, L head, water cooled motor, with bore of 4⅛ inches and stroke of 5¼ inches, the cylinders being cast en bloc. The lubrication is a combination force feed and splash. The ignition is from a Bosch high-tension magneto. The clutch is a leather faced cone and the gearset is selective sliding gear with three forward speed ratios and reverse assembled with the jackshaft and supported by a frame cross member and heavy steel hangers. The frame is constructed of pressed steel channel section on semi-elliptic forward springs and a semi-elliptic platform, with a jack spring as auxiliary. The front axle is an I section and the rear axle a rectangular steel forging. The wheelbase is 140 inches and the tread 56 inches. The wheels are fitted with 36 by four-inch tires forward and 36 by 3½ dual tires at the rear. The steering gear is an irreversible screw and nut construction, with the steering wheel at the left side. The brakes are 10-inch internal expanding and 12-inch contracting in and on drums on the rear wheels.

The company builds several sizes of motor trucks, which are designed especially for public service work. The company has for years specialized in municipal equipment and its machines are developed to meet all the exacting requirements. It is prepared to construct special apparatus of every description.

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ELECTRIC VEHICLE COMPANIES MERGE.

The Baker Motor Vehicle Company, builder of electric pleasure cars and trucks, has been consolidated with the Rauch & Lang Carriage Company, builder of pleasure cars, the merged companies assuming the name of Baker R & L Company. The plants of the company are at Cleveland, O., and they are now being operated jointly, and plans are making for consolidation of the branches and selling agencies wherever practicable. The new company has capital of $2,500,000, of which $750,000 is seven per cent. cumulative preferred and the remainder common stock. Charles L. F. Wieber, Charles E. J. Lang and F. W. Treadway of the Rauch & Lang Company were elected president, second vice president and general counsel of the new corporation, and Fred R. White, Robert C. Norton and George H. Kelley of the Baker company were elected first vice president, treasurer and secretary respectively.

GRAMM-BERNSTEIN EXPANSION.

The Gramm-Bernstein Company, Lima, O., which is owned and operated by B. A. Gramm and M. Bernstein, which until last year was producing 25 trucks from two to six tons capacity monthly, has quadrupled that production, building additions to its factory and increasing its departments. Because of the development of domestic business the company was unable to accept foreign orders offered, but with the completion of two new structures and an administration building, the company expects to have a capacity of 150 trucks monthly by Sept. 1, and it has accepted contracts for sales in France and England that will aggregate $3,000,000. The company builds all of the chassis save the springs, axles and accessories.

A branch of the Federal Motor Truck Company has been established as the Federal Truck Company of Newark at 985-7 Broad street, Newark, N. J., to afford service to Federal truck owners in Essex, Union, Morris, Passaic and the parts of Bergen and Hudson counties west of the Hackensack river. It is in charge of George A. Ludlam, J. H. Conover and J. H. Bowman.

Two of the buildings of the General Fire Extinguisher Company in West Exchange street, Providence, R. I., have been purchased by the J. C. Tucker Company, agent for Chase and Vim trucks, and the main offices of the concern will be removed there from Narragansett Pier and a large service station will be established.

Because of increased business the service station of the Federal Motor Truck Company in New York City, at 146 West 52nd street, has been enlarged to three times its former capacity.

REPAIR PARTS ACCOUNTS.

N. A. C. C. to Standardize Policy of the Industry with Dealers.

Service is the one subject that is now deeply concerning the motor truck industry, and this interest has developed as a result of the convention of truck manufacturers held at Detroit, Mich., early in May. At that time careful consideration was given by the delegates, and there was as thorough discussion as the time available would permit, but while there was unanimity of opinion that there ought to be a standard service policy for the industry, no one was prepared to state what might best serve, and for this reason the determination was deferred until a convention to be called not later than October.

That there might be something tangible and definite for the convention to consider, a committee was appointed to represent manufacturers unaffiliated with the National Automobile Chamber of Commerce, to serve with the commercial vehicle committee of the association and formulate a report that could be presented to the convention with recommendations. So many factors enter into standardization of service that the committee did not feel justified in carrying out its work without full expression of those who have supervision and direction of service, and to obtain this the National Automobile Chamber of Commerce has organized a convention of service managers, which will take place at Detroit, Mich., at the Hotel Statler, June 29 and 30.

The convention is specifically for the purpose of consideration of handling repair parts accounts with dealers representing truck manufacturers, with a view to formulating a standard repair parts policy, and to discuss various phases of service afforded to owners by manufacturers and dealers. The programme as arranged includes a dozen papers dealing with the different subjects, and these will be presented and taken up for discussion.

At the same time this convention is in session there will be a meeting of the special service policy committee, which consists of President Windsor T. White of the White company, Vice President Alvan Macauley of the Packard Motor Car Company, President P. D. Wagoner of the General Vehicle Company, Vice President Martin L. Pulcher of the Federal Motor Truck Company and Assistant Manager H. Kerr Thomas of the Pierce-Arrow Motor Car Company, representing the National Automobile Chamber of Commerce, and President Victor L. Brown of the Sternberg Motor Truck Company, President E. T. Birdsall of the Kosmath Company, Vice President Henry Lansdale of the Denby Motor Truck Company, Vice President H. E. Wilcox of the H. E. Wilcox Motor Company, and Secretary-Treasurer Joseph C. Millmann of the Stegeman Motor Car Company.

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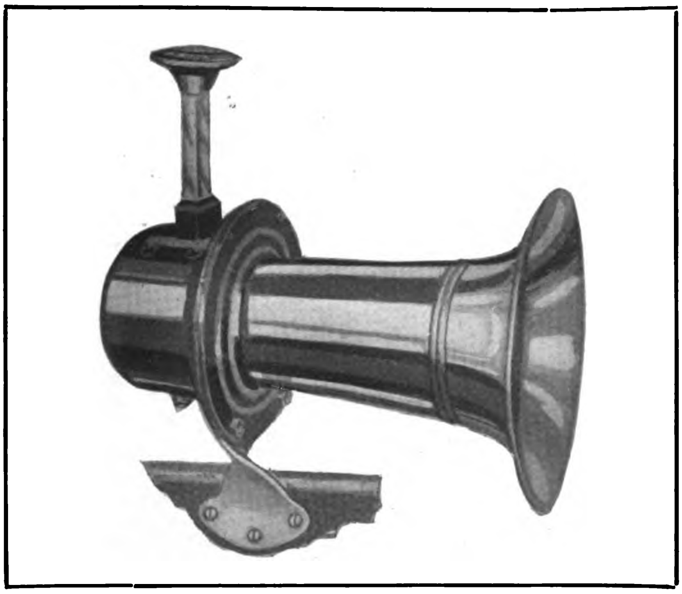
MOTOR TRUCK ACCESSORIES AND EQUIPMENT.

CLERO HAND-OPERATED HORNS.

Two Types of Mechanical Warning Signals Produced by the Fitzgerald Manufacturing Company.

Clero horns, which are highly perfected types of hand-operated mechanical warning signals, produced by the Fitzgerald Manufacturing Company, Torrington, Conn., are claimed by the



The Clero Hand-Operated Horn.

maker to be unusually efficient and to have every advantage besides being sold for exceptionally low prices. These horns are made of highest grade materials, are maintained to be extremely enduring and in service they afford every desirable variation of tone.

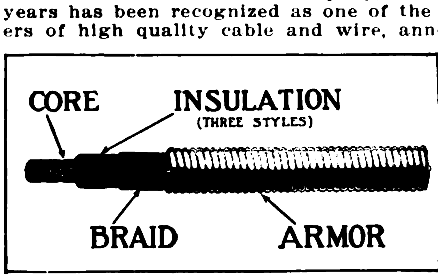
The horns are operated by plungers located at the tops, a slight pressure giving a clear, low tone, while increased pressure will cause sound proportionate to the need. The difference in the types is principally in the length of the projector, the shorter being sold for $3.50 and the longer for $4. The maker claims that these prices are possible because of very large production and manufacturing facilities that afford the greatest economies.

The company is now conducting a very aggressive distributing campaign throughout the country, and by co-operation with jobbers and dealers is promoting the sale of these horns in all sections. The agency proposition for Clero horns is unusually attractive. It will be detailed to all who make request, mentioning the Motor Truck.

PACKARD'S IMPROVED ARMORED CABLE.

Widely Known Wire Manufacturer Produces an Improved Form of Ignition Cable for General Purposes.

The Packard Electric Company, Warren, O., which for 12 years has been recognized as one of the foremost manufacturers of high quality cable and wire, announces the production of an improved form of armored cable for use in the electrical equipment of automobiles, motor trucks and motor boats. This cable is doubly protected, it being thoroughly impregnated with Packard enamel to insure its being water, oil and heat proof, and having a flexible metal covering wound tightly around it to obtain protection against mechanical damage from contacts that might cause wear on any fabric.



Constructional Features of the Improved Packard Armored Cable.

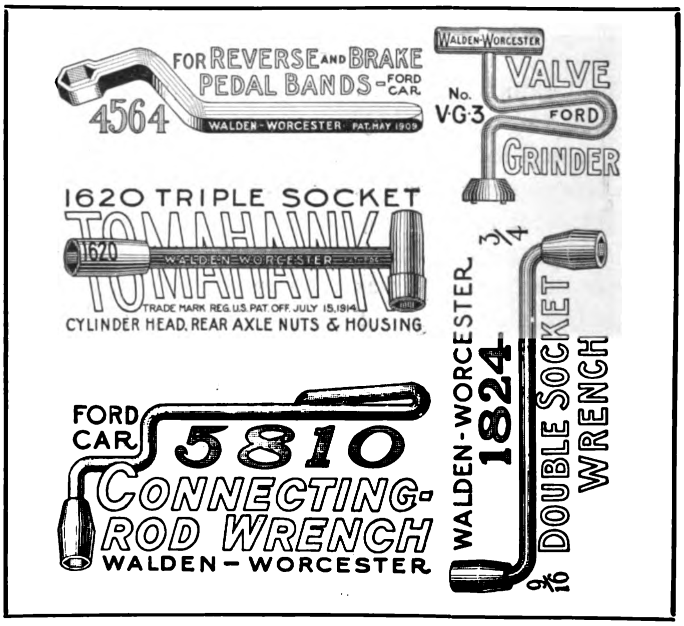
The accompanying illustration shows the constructional features of the cable. Its core is of soft-drawn tinned copper wire, laid in reverse layers to obtain the maximum of flexibility and conductivity consistent with mechanical strength. The insulation covers are made in three combinations, according to the diameter and the service for which the cable is intended; the amount of material used provides a generous margin above safety requirements. The braid is composed of thread made especially for the Packard company and to its specifications. The interstices of the braid are filled with successive coats of elastic enamel, which seals it and makes the cable thoroughly oil and water proof. The all-metal armor is tightly applied, but not so tightly as to materially lessen flexibility. This armor is made in three styles. Of nickeled brass, plain brass and rust proof steel, either of which material gives an ornamental finish to the cable.

The Packard company carries in stock in single conductor cable sizes ranging from No. 18 to No. 00, and in double conductor, from No. 18 to No. 8, and is prepared to furnish 198 different combinations. Other special cables can be furnished on order. Samples of the Packard cables, and additional information will be sent by the company to those who write and mention the Motor Truck.

WALDEN-WORCESTER WRENCHES.

Five Tools Essential for Ford Car Equipment That Permit of Easy Adjustment of Inaccessible Nuts, Etc.

One of the high quality combination wrench sets which the Walden Manufacturing Company, 60 Commercial street, Worcester, Mass., is producing for the Ford car is designated as No. 5 set, and is shown on this page. The set includes a wrench



Walden-Worcester No. 5 Set of Service Wrenches for Ford Cars.

designed particularly for the reverse and brake pedal bands; the peculiar shape of the handle provides ample working space at all times. The double socket wrench is designed to fit the main bearing and engine base bolts, as well as several others. The sizes of the sockets are 9/16 and ¾ of an inch.

The valve grinding tool is all steel, the bar handle of which swivels on a cone bearing, while the pins that fit the valve head are extra hardened. Several purposes are served by the tomahawk wrench, it being designed for the bolts of the cylinder head, rear axle and housing, water intake pipes and many other parts. The connecting rod wrench permits the adjustment of the rods in practically any position without the necessity of removing the motor from the car.

The tools are made of the best material and are fully guaranteed. The retail price of the set is $1.75.

PARTS FOR FORD CARS.

Repair Parts for Ford Cars Supplied to Dealers and Repairmen at Cut Prices.

The Grossman Auto Parts Company, White Plains, N. Y., is prepared to supply dealers and repairmen with a complete line of repair parts for Ford cars at cut prices. The quality and accuracy of all parts are warranted. Some of the several articles offered and their prices are as follows: Differential ring gears, $3; differential pinion gears, $1; front radius rods, $2; rear axle

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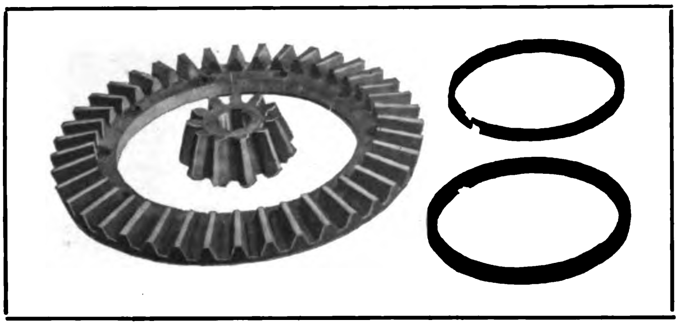
shafts, $1.75; driving shafts, $4; plain piston rings, 10 cents; triple piston rings, 60 cents; front springs, $2.80; rear springs, $8.40; engine valves, 12 cents.

The company also carries a stock of gears, springs and pis-



Grossman Ring and Pinion Gears and Piston Rings.

ton rings for over 40 makes of cars. A complete list and cut trade prices of the various parts distributed by the Grossman company will be sent on request when mention is made of the Motor Truck.

NEW APCO FORD SPECIALTIES.

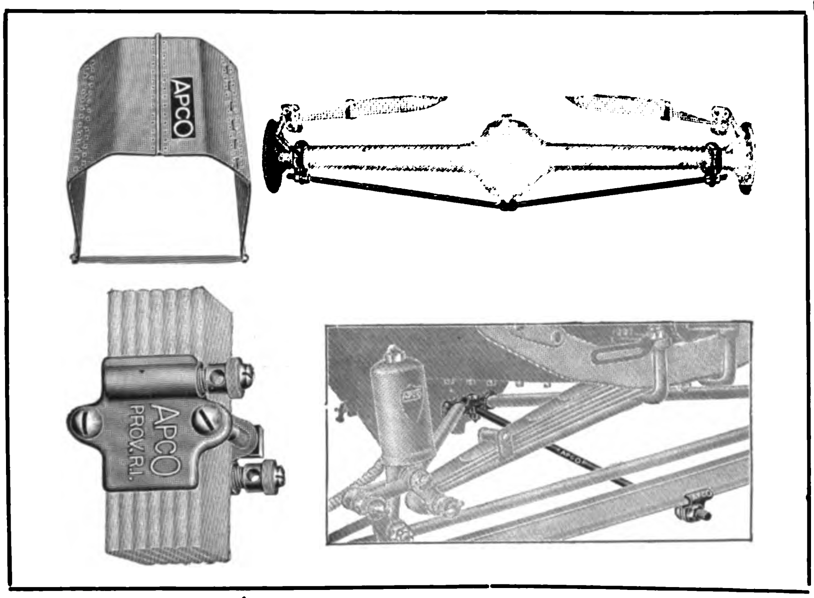
Additional Equipment for Light Delivery Machines Developed by the Auto Parts Company, Providence, R. I.

The Auto Parts Company, Providence, R. I., manufacturer of Apco specialties for Ford chassis, is producing a series of new attachments which recommend themselves to owners because of their practical qualities and comparatively low prices. Of these four are shown in an accompanying illustration.

The front axle brace is shown extending from the centre of the front radius rod to the forward axle. Statement is made that the radius rod will yield slightly, causing the axle to be thrown backward, affecting the steering of the machine. To prevent this the brace has been devised. It is a steel rod and two clamps. One clamp is attached to the V end of the radius rod by three bolts that have square heads fitting into a recess, which prevents their turning. The end of the rod has a square head. The other end of the rod is clamped to the front axle and is retained by two nuts, which extend through the clamp. The brace can be attached with a wrench in five minutes. The weight is three pounds and the cost is $1.50.

The rear axle truss is designed for machines made previous to 1915. The ends of the truss are clamped to the reinforced ends of the axle housing, so that there are no resultant stresses on the tubing, and beneath the differential case is a cradle in which are square sockets to take the square heads that are made integral with the rod. In the clamp is a recess, so that the bolts are flush with the surface. The truss can be installed in 10 minutes. It is adjustable. The price is $1.50.

The Apco spring lubricator is a pair of plates with an oil



New Apco Ford Specialties: At Top, Rear Axle Truss and Hood Anti-Rattler; Below Spring Lubricator and Front Axle Brace.

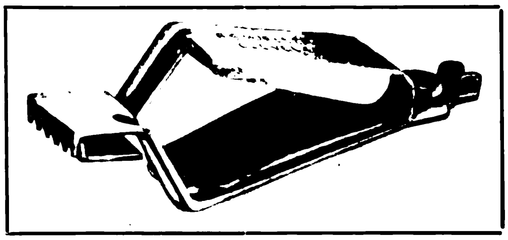
reservoir and felt inserts. The felt inserts are saturated with oil and when attached against the sides of the springs the lubricant is drawn between the leaves by capillary action. The oil insures full action of the springs and greatly improves the riding qualities, as well as protecting the mechanism against wear. The lubricators, which can be quickly attached, sell for $2 a set.

The Apco Ford hood anti-rattler is a length of helical spring with a clamp at either end by which the spring can be attached to the sides of the motor bonnet, under the hood, drawing the sides closely in contact with the seats. When partly or wholly raised the spring tension will hold the hood where set, and both sides can be lifted at the same time, a great convenience when work on the engine is necessary. If need be the hood can be slightly raised to obtain greater circulation of air about the engine. The attachment is finished in black enamel and is sold for 10 cents.

UNIVERSAL TEST CLIP.

A Convenient Cable Terminal That is Extremely Useful in Charging and Operating Lead Storage Batteries.

A fitting that can be quickly and conveniently attached to cable, and which will serve very useful purposes, is the No. 13-A Universal test clip, manufactured by R. S. Mueller & Co., 431 High avenue, Cleveland, O., which is claimed to have many advantages as compared with other types, because it can be instantly attached and certain contact is insured. The clip is constructed of copper, the sides of which are lead coated to protect it against corrosion from acid fumes, and the strong spring is enamelled to similarly protect it. The cable is attached by a screw connection. Statement is made that this clip will not heat when a current of 20 amperes is used.



Universal 13-A Test Clip.

Instead of twisting a cable about the battery terminals the clip is used, the sharp teeth of the jaws cutting any deposit on the binding posts and insuring good contact. The clips are very useful when charging batteries in series, as a number of pieces of cable can be fitted with these terminals, so that connection is a matter of a minute or two. The clips are sold for 15 cents each, in lots of 10 or more for 12½ cents each, and for further reduced price in ratio to the size of the order. All selling information can be obtained from the company at request.

MARTELL ALIGNING REAMER.

A Dependable Labor Saving Tool Which Not Only Bores Crankshaft Bearings, but Burnishes Them.

One of the best and most practical tools which can form part of the equipment of any garage, repair shop or service station, is an efficient aligning reamer for scraping in main crankshaft bearings, as made by the Harding Manufacturing Company and sold by the Harding Distributing Company, 40 Court street (Scollay building), Boston, Mass. The old method of doing this work by hand is very lengthy and uncertain, on account of the necessity of taking many impressions of the heavy crankshaft.

The Martell aligning reamer, manufactured by this company, is guaranteed to accurately bore the bearings to size and also burnish the surface, in less than one-fourth the time that would be taken by hand work. It will be seen that the user of a device of this type should greatly increase his profits by being able to produce a greater amount of satisfactory work, which will always result in increased patronage.

The shaft on which the reamer operates is first lined up in the bearings to be reamed, by means of the adjustment of the aligning shaft by the double eccentric bushings. The two eccentrics, one within the other, are each separately adjusted by means of a vernier reading graduated scale; when the correct adjustment has been reached it is locked in place. The outer surface of the bushing is tapered and finely threaded, so that it may be screwed firmly into the bearings. The correct mesh of gears is easily obtained by means of these eccentric bushings.

Equipment No. 1 is to cover all sizes of crankshaft bearings from 1⅝ inches to 2¼ inches, and equipment No. 2 for smaller bearing work covering sizes from 1¼ inches to approximately 1⅝ inches. A great number of these reamers are now in use in the leading garages and service stations in the country, and have been found extremely satisfactory because of the accuracy of the work and great economy of labor, two very important factors with a business man. The reaming machines are carefully built, of high-grade material, and will afford service for a very long period. The company has many enthusiastic indorsers of the tool and will supply operating data and other information at request.

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The MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

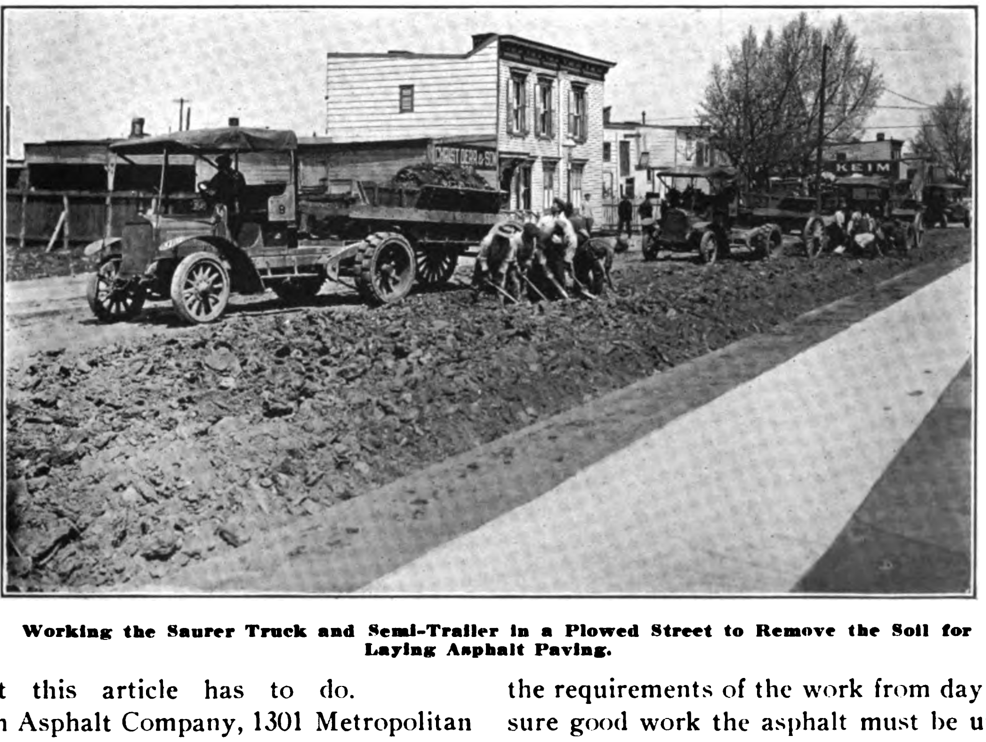
VOL. VI. PAWTUCKET, R. I., JULY, 1915 No. 7

TRACTOR TRUCKS AFFORD LARGE ECONOMIES.

Remarkable Saving and Greatly Increased Efficiency from the Operation of a Fleet of 16 Five-Ton Machines by the Borough Asphalt Company, a Contractor and Manufacturer in New York City.

HAULAGE equipment that is exclusively motor tractors and trailers is not frequently used. Generally speaking, the prevailing belief is that tractors and trailers are only suited for work where large loads are to be carried, and they cannot be utilized advantageously save where the surfaces of the ground is reasonably hard and where the loads can be quickly discharged.

The tractor proper is a power vehicle that does the hauling and carries no load. In the motor truck industry, however, the common acceptance of tractor is a heavy machine that carries a part of a load and hauls the remainder in a body carried on two wheels. Literally, this type is a semi-trailer, and it is with this form of equipment that this article has to do.



Working the Saurer Truck and Semi-Trailer in a Plowed Street to Remove the Soil for Laying Asphalt Paving.

The Borough Asphalt Company, 1301 Metropolitan avenue, Brooklyn, N. Y., contractor for paving construction and maintenance and manufacturer of asphalt paving blocks, has one of the largest, if not the largest, fleets of semi-trailers in use in America. Its experience, extending over more than two years, has demonstrated very conclusively the economy of this form of haulage as compared with animal teams and carts, this proven by careful accounting.

The company has been operating for 25 years and besides its municipal work undertakes private contracts. Its work is all over Greater New York and within a radius of 25 miles from its plant. Its construction work is done during nine months of the year. It is entirely dependent upon the weather, for the asphalt must be laid when the surface is dry, and the material must be heated soft enough to be worked and consolidated. Time is a very important factor and the haulage department of the company must be adequate and efficiently directed.

The asphalt is all prepared for laying at the plant, where the materials are kept in large quantities, and it is prepared to meet the requirements of the work from day to day. To insure good work the asphalt must be uniformly mixed and not over-heated, and for this reason there is greater insurance when this is done under the same supervision and by the same men. The asphalt is made ready in mixing machines and is then hauled to where it is to be laid.

Until two years ago the company used horse carts, having about 50 carts of from $2\frac{1}{2}$ to three cubic yards

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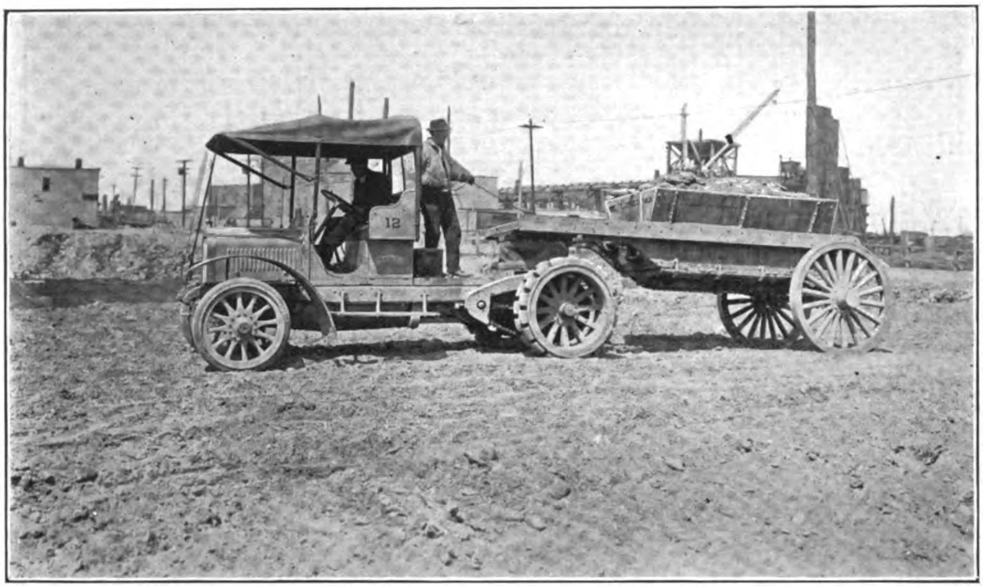


Helper with the Trip Line Ready to Drop Bottom of the Semi-Trailer to Discharge Load.

capacity, and 100 horses, usually worked in teams of two, hiring additional teams in the event of need. Obviously, this equipment was maintained the year through, for horses could not be economically disposed of in the winter and others bought in the spring to save the cost of keeping. So far as possible outside work was contracted for to keep the equipment and the drivers busy.

Bought 16 Saurer Trucks.

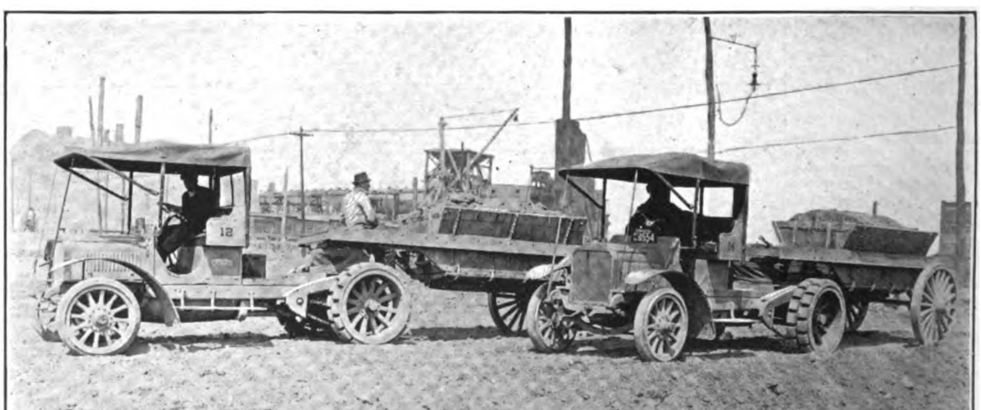
In 1913 the company decided to use motor vehicles for haulage. Standardization was believed sound business judgment and 16 five-ton Saurer trucks with short wheelbase and adapted for use with semi-trailers were bought. Aside from metal guards placed above the driving chains to prevent asphalt dropping on the chains, the machines were to the regular specifications. For use with these trucks, trailers were designed and built to the specifications of the company. These have dead axles mounted on large steel-tired wheels, with long frames that are carried on two semi-elliptic springs on these axles, and on bolsters and turntables at the forward ends. The bodies are built between the side members of the frames and are carried forward of the trailer axles.

The bodies are constructed of wood, lined with sheet steel, the sides having considerable flare and the ends being straight. The bottoms of the bodies are divided longitudinally in two sections, these being hinged at the sides, which fit tightly when closed. The bottoms are held by latches that may be tripped and the sides of the bottom will fall from horizontal to perpendicular positions, so that the contents may drop. With the acute angle of the sides the asphalt, even if the temperature is much reduced, can be discharged, generally without the use of tools to scrape the sides and floor. Asphalt is difficult to handle with the end discharge body, the inclination of such equipment being from 45 to 52 degrees, but the bottom discharging bodies, developed for this particular work, have proven very satisfactory. The bodies are high and the trailer frames appear large and the pockets or hoppers for the material seem comparatively small, but they have capacity of three cubic yards, which is sufficient for the requirements of the company.

Loaded and Discharged by Gravity.

The trailers are loaded by gravity at the plant, the heated asphalt being run from the mixers into the bodies. Usually without covering (tarpaulins are used in the event of cold weather) the loads are carried out, and the trailers can be hauled to the exact point of distribution and dumped. The dumping is done by pulling lines attached to the latches of the bottoms. After dumping the material is spread and worked by hand tools and is eventually rolled to consolidate and even the surface. So far as possible, however, manual labor is eliminated, this applying to the work at the plant in preparing the asphalt, as well as in the construction.

As the gangs start at a definite hour each day and the hot asphalt must be laid as it is delivered, the mix-



Two of the Machines Leaving the Plant with Loads of Asphalt Heated for Working on a Distant Job.

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ing is begun sufficiently early to have loads ready for the men when they begin, and the tractors and trailers are sent away from the plant in season to make deliveries by the time the gangs are at the jobs. After the first loads the tractors are kept almost constantly moving between the plant and the jobs, the number of machines for any one work depending upon the conditions. Naturally the superintendent must have a daily schedule for the tractors, and this can only be made up as the reports of the foremen come in.

Average Daily Mileage from 80 to 100.

The work cannot be done when the ground is wet, and for that reason time is a very important factor, and while each job may have a different aspect normally, the machines are worked considerably longer than the gangs. And there is the distance of the work from the plant, which must also enter into the operation of the machines. The daily mileage of the tractors will average not less than 80 and sometimes more than 100, but from 80 to 100 miles is regarded as being the normal day's work for a machine. The hours of the men may appear long, but there are periods of enforced idleness, in the event of storms, bad weather and the like, so that their average hours are not excessive. Statement might be made that the men work long hours while they are busy, but they are constantly employed and when paving cannot be constructed they are given other work about the plant, hauling tools and equipment from the jobs, etc.

During the period of the year when the company can do no work the machines are rented at a stated price with the service of the driver, and such helpers as are necessary, and each winter, so far as possible, the company will contract to do haulage for other concerns. While all are not always thus employed, there is considerable revenue from this source. In the winter the machines are overhauled and placed in the best of condition for the season's work.

Maintains Its Own Garage.

The company maintains its own garage, which is in charge of a foreman, whose duty is to maintain the tractors and the trailers in operative condition, and he has workmen regularly employed, as well as the service of the driver anl helper when necessary. The garage has a well equipped shop and all facilities for making repairs and replacement of parts. The company is a considerable distance from the service station of the International Motor Company in Manhattan, and besides the general work of upkeep is done nights and Sundays. There is a sufficient number of tractors so that in the event of the withdrawal of one the work would not be seriously affected.

When the company began to operate its tractors a very thorough system of accounting was adopted, and this was placed in charge of an expert whose duty is to learn costs and by constant comparisons in reports submitted to the executive of the company afford means of determining efficiency and economies. Each driver makes a daily report to the garage foreman when he brings his machine in and systematic care and attention is given. The foreman in turn makes each morning a report covering the condition of each tractor and trailer, and other records cover the supplies furnished, the work done, labor, repair parts, causes of withdrawal, progress of repair, needs to maintain equipment, and the like.

The data of the reports are gone over carefully and entered in the records, so operating cost and revenue are compiled to show footings for the day, the week, the month and for the year, with every item of expense or income included. The overhead is quite as closely analyzed.

An Example of the Condition of the Ground on Which the Trucks Are Frequently Operated, Where Ample Power Is Needed.

The advantages of the machines, besides having the use of the property used for stables and wagon yard for other purposes, are numerous. With 100 horses, with reasonable allowance for animals idle from various causes, 45 carts could be depended upon. With mileage of 20 for each team, a figure that would hardly be approached in regular service, this would be a total of 900 miles a day for the carts. Allowing an average of 90 miles a day for each tractor, this would be 1400 miles a day, or 60 per cent. more than the animals. That is, generally speaking, 16 tractors have replaced 45 teams of horses, or three teams to a tractor, and the tractors do 60 per cent. more mileage, so that each tractor is equal to five teams, and there is a con-

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siderable saving in the cost of drivers, for the tractor has a driver and helper as against at least one man to a team. Not only that, there is the reserve capacity of the machines, which is a factor worthy of special consideration.

Trucks Have Large Capacity.

There is a limit to the working capacity of animals, but the tractors can be used with equal efficiency, no matter what the period of the day, and as long as work can be done. With the tractors the work at the mixers at the plant can be started later. The material can be delivered in better condition for working, and the construction is improved because of the fact that the material can be properly worked.

As to expense of the machines, this can be best established by a brief statement, in which emphasis should be made that they are never overloaded and are not driven fast, but they are kept moving every minute of the time, for loading and unloading can be very quickly done. This statement covers the expense for interest, insurance, depreciation, replacement of parts, wages, gasoline, oil, waste and grease. The average fuel consumption during this period was four miles to the gallon and the oil consumption 60 miles to the gallon. These two items will show very good fuel economy and abundant lubrication.

Example of Operating Cost.

Including these items the total expense of operating six tractors for nine months, which is practically an operating year for the company, was $14,041.08. The average cost of operating each of these tractors was $2340.18, or $8.48 for each day of the nine months, or 276 days. This shows an average weekly cost (seven days), of $59.36, and dividing this by six to obtain the cost of each working day, or day when work could be done, this showed the expense to be $9.89. This does not account for time lost, and neither does it account for overtime the machines were operated. It is an average of expense covering the actual service period for each day, the assumption being that so far as operation is concerned an average amount for each day is even more definite than an average for each working day. The working day cost could be exactly apportioned on the basis of miles operated, but this would show variable expense from day to day instead of an average. Incidentally, this daily average is better adapted to comparison with horse haulage figures, which must cover seven days for a week.

The company had 100 horses in service when the tractors were bought, and while this number was regarded as sufficient to meet the regular requirements, to have the same animal capacity as it now has with its machines this total would have to be increased to 160, and then there would be no reserve. Assuming the cost of the 16 tractors to be $8.48 a day, and the 80 teams of two horses to be $5 a day, the aggregates would then be $135.68 for the tractors against $400 for the animals. This is a striking illustration of the economy of the tractors.

The tractors could probably haul much heavier loads on ordinary roads and streets, but because they are worked frequently in soft and rough ground, where construction is progressing, the loads are comparatively light. But at the other hand the mileage is practically double what would be regarded as normal for machines of this size and type.

SEVEN SIZES OF KISSELKAR TRUCKS.

Seven sizes of KisselKar trucks are now on the market, ranging from 1000 pounds to six tons. The intermediate sizes are ¾ to one-ton, one to 1½ tons, 1½ to two tons, 2½ to three tons, 3½ to four tons. Of these the 1000-pound delivery car is the new member of the group and it marks the entry of the Kissel company into the light commercial vehicle field.

The stripped chassis weighs 2200 pounds and the length overall is a little more than 14 feet. It carries a new Kissel motor of 32 horsepower. The wheelbase is 115 inches. Another important change in the line is the adoption of a worm drive David Brown rear axle for the medium size models.

All trucks motors are built in the Kissel shops. The two smaller sizes have 32 horsepower, the next two 36 horsepower, the 2½ to three-ton truck has 40 horsepower and the two larger sizes have 50 horsepower.

Bodies and equipment are supplied for street sprinklers and flushers, dumping wagons, fire apparatus, ambulances, police patrols and "jitney" 'buses.

NEW KNOX SALES MANAGER.

The Knox Motor Associates, the organization marketing the products of the Knox Motor Company, Springfield, Mass., has announced the appointment of C. F. Rouz as sales manager, succeeding H. F. Blanchard, who recently resigned to become a motor truck buyer for one of the belligerent nations.

Mr. Rouz has been in charge of the company's Kansas City branch since February, 1914, and has a long experience in both the motor truck and motor tractor field. He entered the motor truck industry in 1909, when he became associated with the Rapid Motor Transportation Company. Later he was with the truck department of the United Motor Company as western supervisor and with the American Locomotive Company in a similar capacity.

BIG PARTS DEMAND AFTER WAR.

An officer of a belligerent army who has been in this country in connection with the purchase of trucks, is quoted as saying that in his opinion Europe will not only absorb all the trucks that have been used in military service, but will give rise to so large an additional demand that European makers in order to keep up will have to buy American parts and assemble them on the other side.

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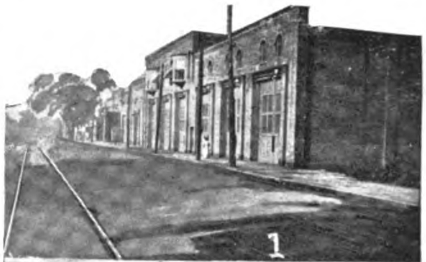
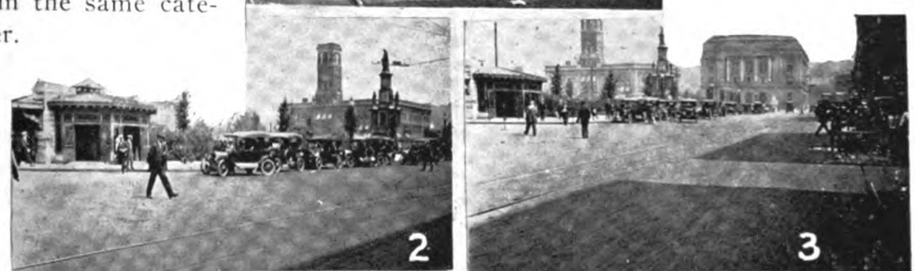
TRUCKS "FIRST AID" IN BIG TROLLEY STRIKE.

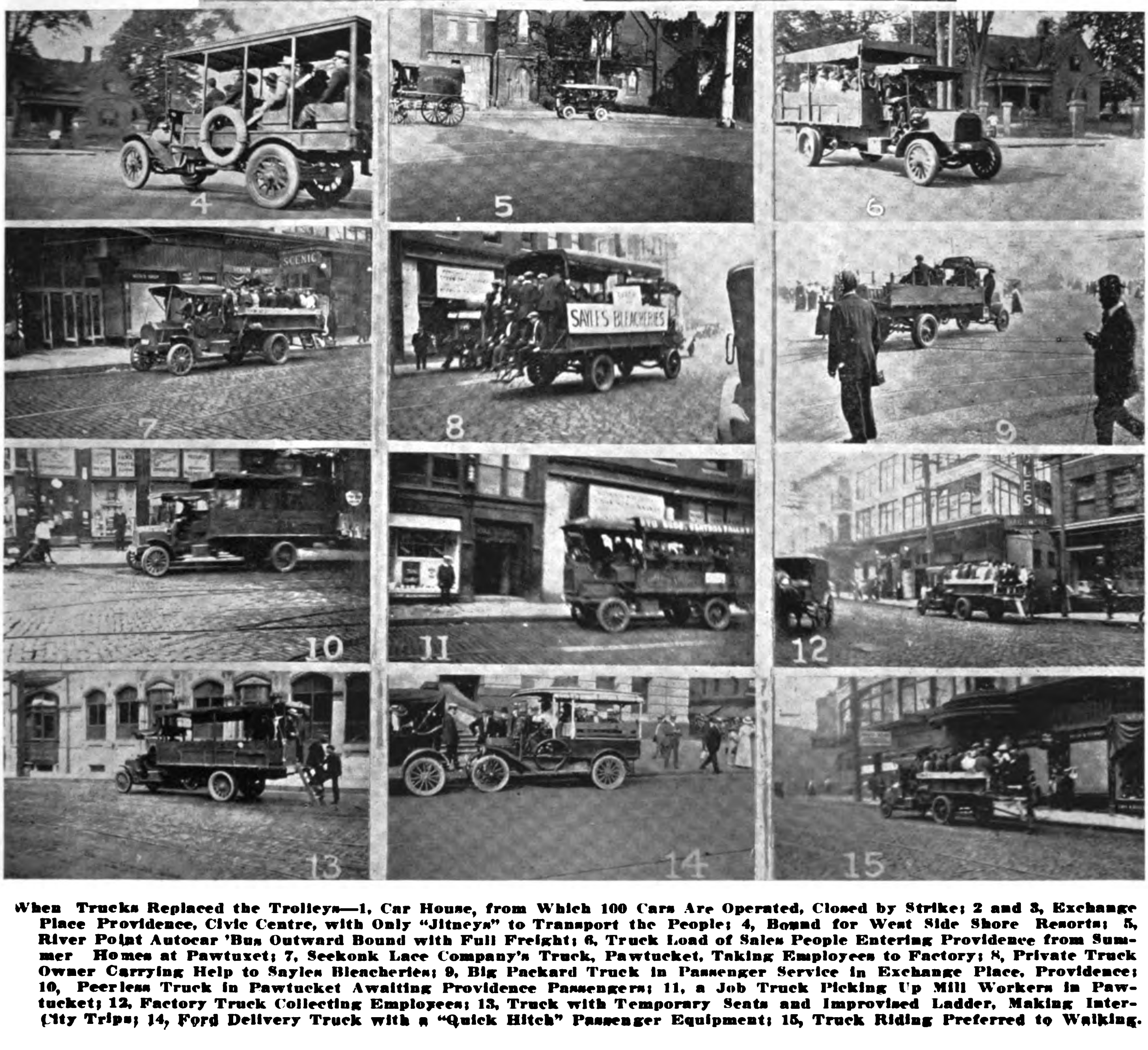
TO WHAT degree the people are dependent upon public transportation service is seldom understood until some circumstance that is quite beyond the power of the operators to control causes a great curtailment or cessation of the facilities that are ordinarily available. Such exigencies are either the result of a catastrophe or a strike, and viewed by the ones who are the real bearers of the burden—the people—the second cause may be included in the same category as the former.





Though the public transportation companies systematically and carefully serve the people, because this is a matter of profit or loss, and there is no probability of substituting what may be regarded as satisfactory service should they suddenly cease to transport the public, the hardships and much of the inconvenience incidental to lack of travel facilities can be largely eliminated through the utilization of motor vehicles until operations are resumed.

The best demonstration of the possibilities through the substitution of privately owned cars and trucks for street cars ever known in America, hap-



When Trucks Replaced the Trolleys—1, Car House, from Which 100 Cars Are Operated, Closed by Strike; 2 and 3, Exchange Place Providence, Civic Centre, with Only "Jitneys" to Transport the People; 4, Bound for West Side Shore Resorts; 5, River Point Autocar 'Bus Outward Bound with Full Freight; 6, Truck Load of Sales People Entering Providence from Summer Homes at Pawtuxet; 7, Seekonk Lace Company's Truck, Pawtucket, Taking Employees to Factory; 8, Private Truck Owner Carrying Help to Sayles Bleacheries; 9, Big Packard Truck in Passenger Service in Exchange Place, Providence; 10, Peerless Truck in Pawtucket Awaiting Providence Passengers; 11, a Job Truck Picking Up Mill Workers in Pawtucket; 12, Factory Truck Collecting Employees; 13, Truck with Temporary Seats and Improvised Ladder, Making Inter-City Trips; 14, Ford Delivery Truck with a "Quick Hitch" Passenger Equipment; 15, Truck Riding Preferred to Walking.

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pened in Providence, R. I., and the adjacent cities and towns, July 15 and 16, when the conductors and motormen employed by the Rhode Island Company, which operates lines extending from 15 to 25 miles from Providence, struck work eight hours after an ultimatum had been sent the company.

One Result of the "Jitney" Craze.

Beginning early in February, Providence, Pawtucket and the contiguous towns and cities were visited by the most intense wave of "jitneyism" ever known in any section of the country. Within two months more than 1200 "jitney" licenses had been issued, and for the next two months the "jitney" drivers flourished and disappeared as they realized that after the sensation of riding in an automobile for a nickel had been satiated the people were satisfied with the systematic service of the trolley cars, and besides, there was not much profit for much hard work when all the bills were paid. Some of the more businesslike drivers found they could make reasonable wages as the number of "jitneys" decreased, and when the street railroad employees obeyed the mandate of the union and "pulled in" their cars, there were perhaps 150 "jitneys" affording more or less uncertain service.

Manufacturers Anticipated Conditions.

Manufacturers of Rhode Island had one experience with a prolonged strike of the street railroad men a number of years ago. Just now a large number of industrial concerns are working full time, or overtime, and when the diplomats representing capital and labor could not agree and a strike seemed imminent, the local captains of industry realized that in the event of the probable strike they would suffer because of the inability of employees living at distances to report on time—at least until there was definite knowledge of what conditions must be met. The most far-sighted of these, who own trucks, made provisional arrangements with their labor for those living at distances and in specified localities to assemble at certain central points at stated times, provided that they had knowledge of a strike, which was set for midnight. The drivers of the trucks, in the event of a strike, were to be at the places designed and bring the workers to the shops, factories and mills. These arrangements were in anticipation of the railroad men leaving work, and insured against much delay of the employees.

The plan stated was followed by a number of concerns employing women and girls, but generally where the workers were men they were not thus provided for. Some companies not owning trucks arranged with job truckmen to make trips between certain meeting places and the works before the time for beginning work and after closing for the day.

Half a Million Dependent on Motors.

The strike stopped the operation of something like 500 trolley cars, and fully 500,000 people were dependent upon the New-Haven railroad and the trucks and automobiles that were available. The company operated a very few cars for approximately 12 hours of the day. These were generally well filled with passengers, but the time was so uncertain that no one for a moment considered them. People must be moved, and moved quickly. Of course there were all manner of extemporized vehicles, from antiquated bicycles to ancient horse cars mounted on road instead of track wheels, and those owning animals found ample opportunity to work them far beyond capacity.

But the surprise of the situation was the transportation that became available immediately the strike was declared. Every man who possessed a "jitney" license saw his opportunity, and those who had abandoned the work turned to it almost instantly. Owners of trucks with a few lengths of plank and hastily constructed ladders converted their machines for passenger carrying all the time they could be spared from the work usually engaged in. All kinds of motor vehicles, from the antiquity that sounded like a boiler shop to the spick and span car just delivered were utilized. Hundreds of car owners who had used their machines for pleasure only realized the possibilities of earning real money and without licenses carried passengers all the hours of the day they were not otherwise employed. Many men allowed their sons to use their cars for the profit that appeared so certain.

No Strict Regulation of Cars.

The police authorities were extremely lenient. Ordinarily "jitney" licenses would be required of all persons carrying passengers, but in the emergency all that was done was to control the vehicle traffic in the streets. The "jitney" drivers were not confined to the standard "jit" for fares, but exacted anything that was reasonable without protest. The streets were filled with motor cars and trucks and horse vehicles, and, while the people were inconvenienced as to hours, especially those who were accustomed to lunching at homes some distance from business or work, the public was surprisingly well cared for, and all this without organization or system.

Surprising as the statement may appear there was no protest made by the people. They accepted the situation philosophically and made the most of the catch-as-catch-can transportation, and though the strike was ended by an agreement of the car men to arbitrate and to resume work pending arbitration at the end of the second day, by that time the men temporarily transporting the people had adjusted their services to meet the needs and the conditions were improving hourly. There is no doubt that the people morally approving the position of the railroad company, and the remarkable efficiency of the motor cars and trucks, and the elasticity of the service afforded by them, were large factors in influencing the trolley employees to accept the proposition which they first rejected and which was the principal reason for the strike.

The strike was not of a length to thoroughly demonstrate what would be possible with well organized and directed motor equipment, for practically every machine was independently operated, but it undoubtedly evidenced remarkable possibilities.

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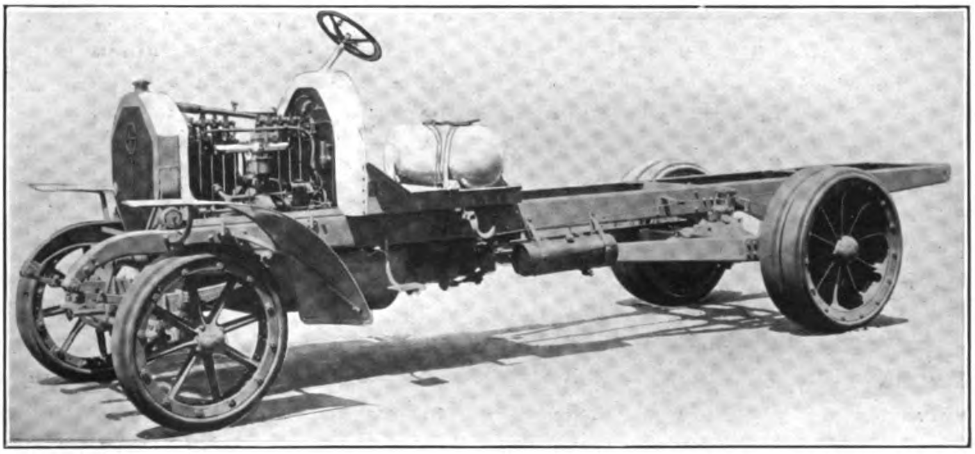
INTERNAL GEAR DRIVEN G-V MERCEDES TRUCK.

Some of the Characteristics of a Driving System Developed by 15 Years' Service Experience Abroad That Has Extreme Endurance and Marked Efficiency.

UNDOUBTEDLY the largest truck made in America that is driven by internal gears is the General Vehicle Mercedes, or G-V Mercedes, built by the General Vehicle Company at its factory at Long Island City, N. Y., and it is in duplicate of the truck built in Europe under the name of Daimler, by the maker of the world-known Mercedes pleasure cars. This machine has a load rating of five-six tons, the variable being from the fact that as a rule the foreign ton is 2240 pounds, so that a vehicle having an English rating, for instance, of five tons, would really have capacity of 11,200 pounds instead of 10,000, if the American 2000-pound ton were the unit.

The Daimler or Mercedes truck is of more than ordinary interest to the engineer, the mechanic and to the owner, from the fact that it represents the development of 15 years. This machine was the first construction in Europe in which the internal gear drive was incorporated, and the principle has been developed until it has reached a stage or condition where it may be said to be standardized.



Side View of a Stripped G-V Mercedes Chassis That Is of 5-6 Tons Capacity.

The internal gear drive cannot be regarded as being more highly developed in Europe than in America, because this system of power transmission has been used in this country for nearly 15 years with undoubted success, but the use has been much more general abroad and the practical value and utility has been well established. The internal gear, however, has never been used for pleasure vehicles, because two rear axle units, the dead axle to carry the load and the jackshaft or live axle, appeared cumbersome, and two large wheel drums were necessary to carry the internal ring gears by which the machines are driven.

The principle of the drive system is to carry the load on a dead axle and either to mount the jackshaft, driven by the main shaft, on the axle, either in front, behind or above it, the jackshaft and the driving shaft being fully enclosed and protected, this affording ample strength with comparatively light weight, while frictional losses were minimized because of the thorough lubrication of the moving parts.

The Daimler or Mercedes internal gear construction was used with trucks, but the earlier Mercedes pleasure cars were driven by chains. The belief was that the car would receive careful attention because of the regard of the owner for its appearance, but the truck, being used in all conditions of operation, ought to be as fully protected against wear as was possible, and should be highly efficient and extremely enduring. One of the principal reasons for the careful consideration of power conservation was the necessity of economizing fuel consumption, this being impelled by the high cost of gasoline or petrol, and to accomplish this bearings were perfected to reduce friction and the driving system that would insure the highest degree of efficiency was adopted.

In Continental Europe the internal gear drive has received greater attention from the industry than any other used for freight vehicle propulsion. This system can be built to have very large gear reduction at the wheels and at the same time the reduction at the drive shaft may be correspondingly small, so that the driving shaft may be driven with higher speed than any other construction. High speed means also comparatively lighter parts, a very desirable quality when propelling power is to be obtained with minimum consumption of fuel.

Trucks of Largest Size.

The Daimler design was originally created for the construction of a heavy truck, a much heavier machine than there was material demand for in countries of Europe, because the builder anticipated that as motor freightage increased in volume the units of service would be larger, and the designs of vehicles built for light, fast work, could not be adapted to meet these requirements. For this reason the Daimler machines were developed slowly and with extreme care and the trucks used in heavy service under systematic observation, because the system of governmental subvention was applied to them. That is, owners of these vehicles were paid a stated sum annually by the government

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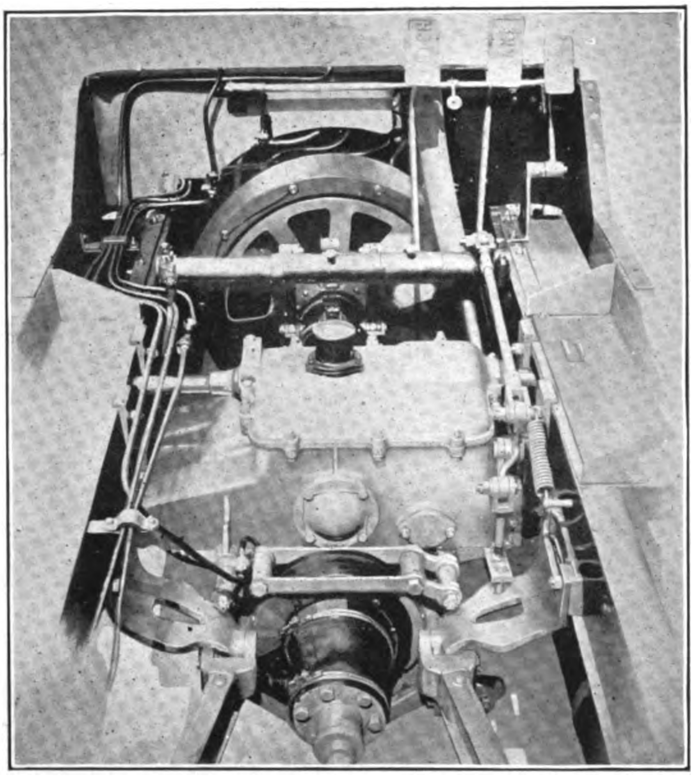


The Four-Speed Ratio Gearset, the External Shaft Brake and the Radius Rods Forward Connection.

for having approved haulage equipment that might be utilized for military transport in the event of need.

Large trucks are not as a rule as generally used in Europe as in this country, despite the better roads, and subvention has been adopted by the majority of the nations for the purpose of promoting the construction of vehicles that might in the event of war be available for the service of the army. In other words, there was the stimulus of the government subsidies to encourage the ownership of machines that were regarded as being satisfactory in design and construction to endure hard service. While the domestic market was limited the possibilities of other countries were considered, and a considerable number of these trucks were sold in other nations, where service alone was the incentive for purchasing them. In Russia and in several South American states, where the highways are comparatively undeveloped, the trucks were utilized with extreme satisfaction.

Aside from the matter of endurance, European truck manufacturers must give attention to requirements that are not so important from the viewpoint of the American builder. One of these is large development of power with comparatively small fuel consumption, and another is noiseless operation, for law or police regulation demands that the trucks shall not be noisy. Simplicity, accessibility and minimum labor for care and attention are essential.

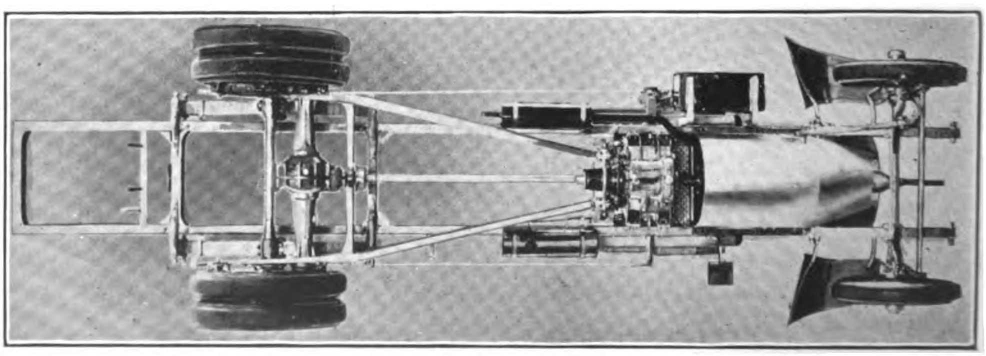
When the General Vehicle Company, which is the largest builder of electric trucks in the world, decided to engage in the manufacture of gasoline trucks, the engineering department made careful investigation of what were regarded as the leading types of machines constructed in Europe, and then acquired the rights to build the Mercedes type in this counry. This done, the company made such additions to its factory as were necessary, and it is now just beginning the production of these trucks. While there are comparatively few machines of the Mercedes type in use in the United States, and not a sufficient number for them to be generally known to truck owners, there is no more favorably regarded truck in Europe than the Daimler.

The Daimler trucks, however, are by no means the only make in which the internal gear driven system is used. As a matter of fact there are a considerable number of manufacturers who have adapted this system, somewhat differently applied in some instances, and these are used for all manner of services with equal satisfaction. One of the claims made for the drive by internal gearing is that there is the same high efficiency in power transmission, no matter what the speed of the vehicle, and through the very large gear reduction in the wheels extreme driving power can be obtained.

Features of the G-V Mercedes.

In the G-V Mercedes the internal gears are very large and the spur driving pinions of the jackshaft are so far from the axle that the power is applied close to the rim of the wheel. This greatly increases the leverage and better utilizes the power, so that extremely hard work can be accomplished without excessive engine speed or high consumption of fuel. The ring gears may be said to be as large as can be used and have sufficient road clearance to insure against damage from obstructions.

The European engine builders have endeavored to obtain power efficiency without large engine capacity, a result that was found to be intensely practical with the internal gear drive because of the reduction possible, and in addition to this the G-V Mercedes truck has a transmission gearset that has four forward speed ratios, this affording even greater possibilities. Of course much depends upon the design of the motor, and this is an overhead valve type with bore of 4¼



Bottom View of a G-V Mercedes Chassis, Showing the Method of Mounting the Jackshaft on the Radius Rods and Rear Axle.

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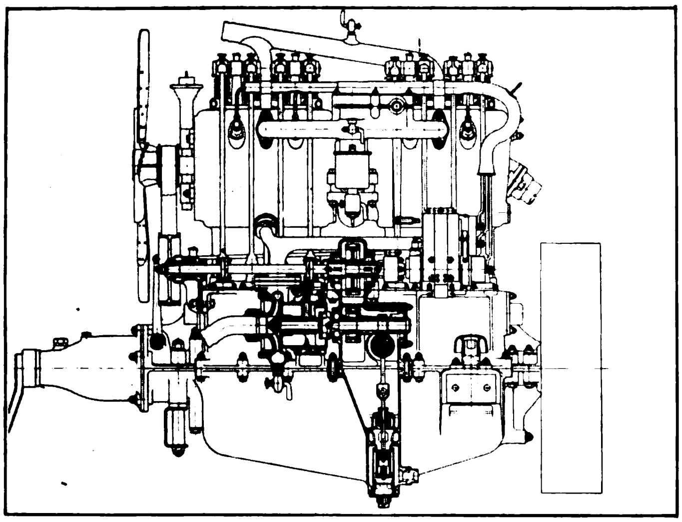


The G-V Mercedes Four-Cylinder Overhead Valve Engine, Showing the Centrifugal Water Pump and Worm Driven Mercedes Oiling System Detail.

inches. The maximum speed is 850 revolutions a minute, which is comparatively slow when contrasted with the average American motor. By the S. A. E. formula this is rated at 28.9 horsepower, but the claim is made that this will develop 35 horsepower, which is regarded as more than sufficient for any requirement. The maximum speed of the truck is 10.8 miles an hour, which will compare favorably with any machine of its size and type.

The Power Transmission System.

The greatest interest to the motor truck engineer or mechanic is in the power transmission system, which may be regarded as from the clutch to the rear wheels. The clutch is a cone of pressed steel, formed with blades, that has a wide face and is $19\frac{1}{8}$ inches diameter. This is leather-faced. The size of the clutch means minimum wear and the extremely large area insures maximum efficiency. This is a factor of importance when service is considered.

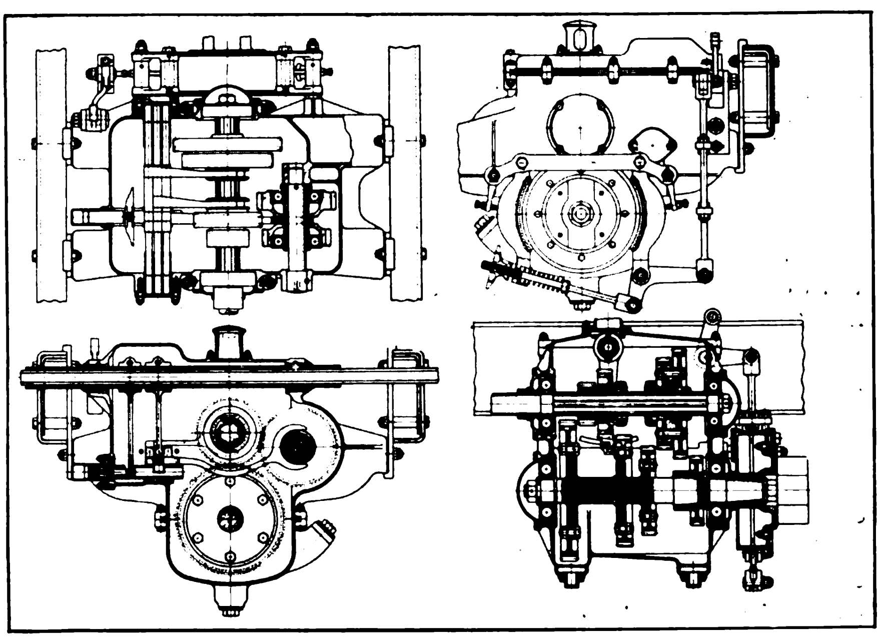
Back of the clutch, supported from the frame at four points, is the selective sliding gear gearset. The gearset assembly is very large and the case is carried on four brackets that are bolted to the frame and to the case, the case being low because of two-shaft construction, the upper being the driving and the lower the driven shaft. This gearset has no gears constantly in mesh. The upper shaft is coupled to the clutch shaft, and on this are mounted two two-faced gears that are slidable either forward or back. These in the order of sizes from the front are first, second, third and fourth. Below this is the driven shaft, on which are four fixed gears, the slidable two-faced gears being between the first and second and the third and fourth.

The gears may be all disengaged, this being the neutral positon, or any one pair of them engaged by the movement sliding gears on the driving shaft. The reverse is obtained by the movement of the first and second ratio gear on the driving shaft and the movement of a two-faced gear that is slidable on a countershaft. By the action of the lever the second ratio gear of the driving shaft is meshed with the larger of the two-faced gear on the countershaft, and the smaller of the two-faced gear on the countershaft, is meshed with the first speed ratio gear on the driven shaft, this reversing the movement of the driven shaft. The construction and the action of the gearset may be the better understood from examination of the drawing which illustrates the case and a top view and a vertical section of the assembly. As will be noted, the shafts and gears are very large and the shafts and the countershaft gear are all mounted on annular ball bearings. In connection with the gearset, mounted at the rear of the case and actuated by linkage shown on the case, is the large drum brake on the extension of the driven shaft of the gearset. This is the service brake, having shoes of the locomotive type, and this can be fitted to be water cooled by a system containing $4\frac{1}{2}$ gallons of water that is under 10 pounds pressure to the square inch.

The Main Shaft and Jackshaft.

There is a universal joint just back of the brake drum. The shaft extends back to the jackshaft, which is mounted on a frame formed of the two radius rods and a substantial cross member. These radius rods are mounted with collars that encircle the axle, so that they may move in a vertical plane, and the rod ends are extended behind the axle to carry the anchorage studs for the external band brake shoes that operate on the drums in which the internal gearing is enclosed. The forward ends of the radius rods, as may be seen in an accompanying illustration, are pivoted to a dropped frame cross member directly back of the service brake, so that they may have a vertical movement.

The rear axle is a steel drop forging on which the



The Detail of the Four-Speed Ratio Gearset, in Which No Gears Are Constantly in Mesh and the External Service Brake.

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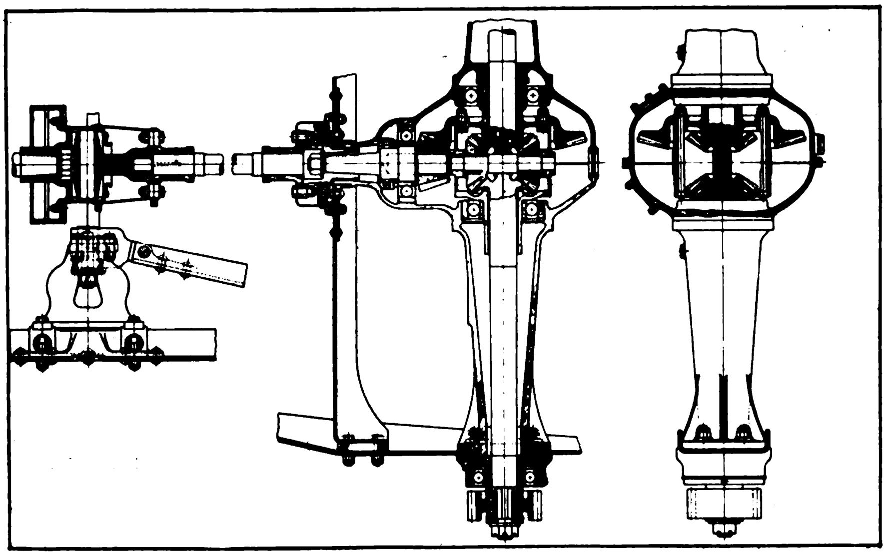


The Driving System, Showing the Main Shaft Universal Joint and the Construction and Mounting of the Jackshaft.

move with them, these plates carrying packing rings that fit over the edges of the drums to exclude the dust. The construction is extremely light and simple. The drums that carry the internal ring gears are the drums for the emergency brake, and having extremely large surfaces, this brake is very efficient.

The steel chassis frame is mounted on semi-elliptic springs, the rear set being outside of the frame and shackled at both ends, the driving and braking thrust being taken by the radius rods. When the truck is loaded the radius rods and the driving shafts are very nearly horizontal, and there is but very little variation in the position of the shaft in normal driving.

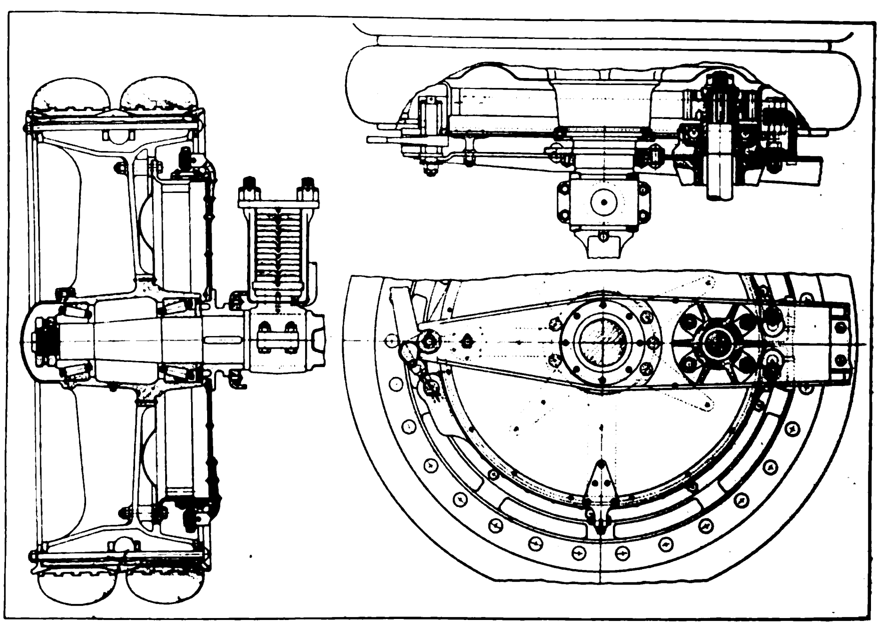
spring seats are forged, and when the rear axle assembly is made the jackshaft is bolted to the axle beam and the outboard ends of the jackshaft housing are mounted in the heavy radius rods. The jackshaft housing has a forward extension to enclose the driving shaft and pinion, and this is carried forward to and secured to the cross member between the radius rods. When the front ends of the radius rods are free the rods and the jackshaft may be raised or lowered, the jackshaft pinions moving within the internal gears. In the assembled chassis the driving relation of the jackshaft spur pinions and the internal gears is always maintained, no matter what the vertical movement of the axle, and whether the degree of angularity of the radius rods and the driving shaft is increased or decreased the driving efficiency is not affected.

The jackshaft is enclosed in a small diameter steel housing and it is a conventional type, the differential gearset being assembled with the bevel master gear. The housing is divided vertically in the centre. The gearset and the shafts are carried on large annular ball bearings, with a liberal sized thrust bearing, and the outboard ends of the shafts are mounted in annular ball bearings in seats that are bolted to the radius rods and to the jackshaft housing. The pinion shaft is carried in the forward extension of the jackshaft housing, this being mounted on annular ball radial and thrust bearings, and the sleeve in which a telescopic connection is made with the driving shaft is carried in a ball bearing, which is protected by a large dust cap.

The internal ring gears are bolted to the steel wheels by lugs with plates that form the outside of the drums. The inner plates are bolted to the radius rods and are free to

As will be noted, the shaft, radius rods, jackshaft, rear axle, brake shoes and drums and springs may be regarded as a unit, connected with the driving system by the universal joint and the radius rod pivots, and by the spring shackles and brake linkage. This construction minimizes stresses of load or road shock and the frictional losses are very small.

The chassis has wheelbase of 169¼ inches and tread of 60⅝ inches, with overall length of 258⅝ inches. The total weight the chassis is built to carry, including the body, is 14,000 pounds. The other details show that the ignition system is energized by a Bosch high-tension magneto, with fixed spark, the motor is lubricated by a circulating pressure feed system to the crankshaft and connecting rod bearings, and the engine is cooled by a centrifugal water pump that forces water through the jackets and the cellular radiator. The drive is right side, with the gear shifting and emergency brake levers at the driver's right. The steering gear is semi-reversible, a nut and screw type.



The Rear Wheel Assembly, Showing the Detail of the Internal Gear Drive and the Brake Construction.

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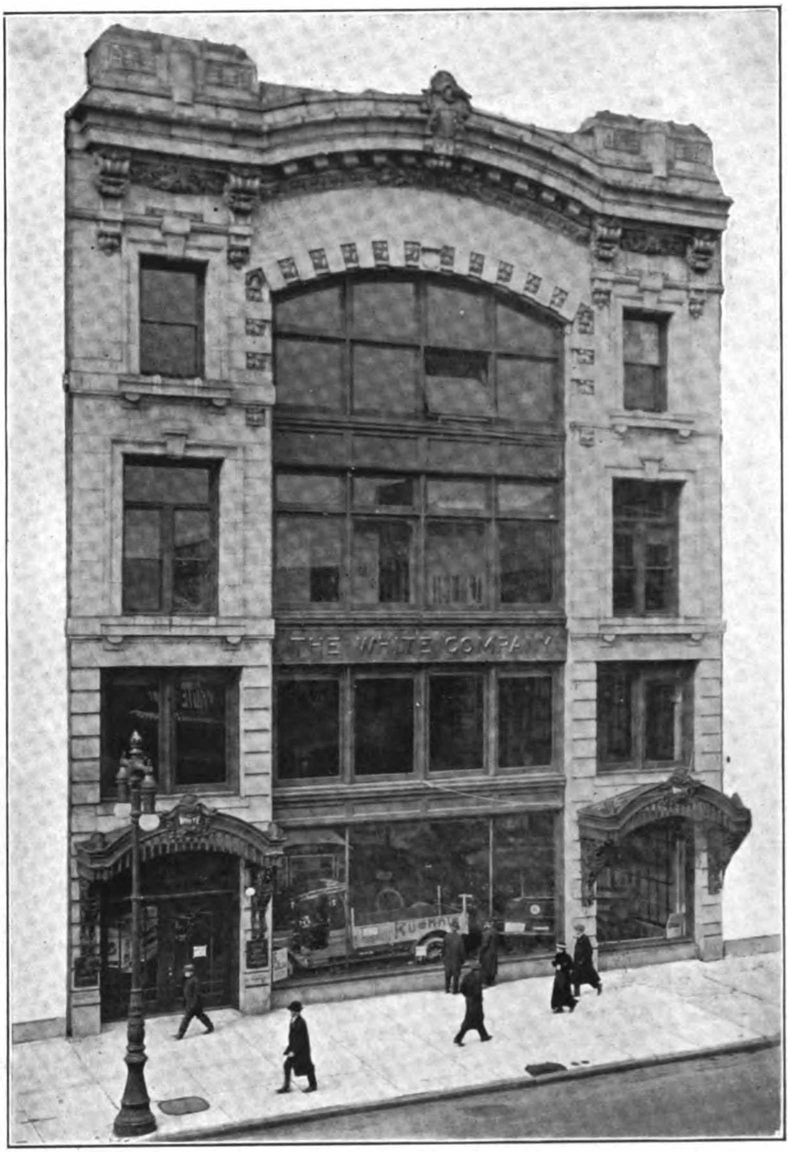
TRUCK ECONOMY FROM MAKER'S SERVICE.

Saving of Legitimate Maintenance Cost and Insuring Maximum Operation Through Supervision of Mechanical Efficiency the Method of the White Company.

EDUCATION of business men to their own responsibilities in the use of motor truck and to the necessity of maintaining their machines in the highest state of mechanical efficiency, and co-operating with them so that there shall be as nearly as is practical continuity of vehicle service, is the purpose of every manufacturer. When trucks are in readiness for the sales departments to distribute to the different selling representatives, they are regarded as factory perfect and are guaranteed to the purchasers by the builders' warranty, and should there be failure from defective material or faulty workmanship, the manufacturer must make such replacements as are covered by the terms of the contract, but the operation of the vehicles and mechanical maintenance are obviously the owners' responsibilities.

The manufacturers of trucks and wagons since the inception of the industry as individuals have endeavored to serve and satisfy their customers, but for a considerable period the largest concerns have sought to create organizations that would materially assist the owners to practically keep their machines in mechanically operative condition, as well as to minimize operating cost. Each company has dealt with its own problems according to the judgment of its executives, meeting the conditions as developed from time to time, and gradually formulating policies which were found to be best for all interests.

Of course much depends upon the market, for obviously companies operating throughout the entire country would necessarily have standardized policies, which would be applied uniformly, and the development of system and organization would be an item of considerable expense, as well as the cost of maintenance. To apply these policies also necessitated organization of the branches and agencies to the extent of having standard resources and facilities for the service of the owners, so that the machines could be kept mechanically efficient with a minimum of lost time.



The Branch of the White Company at 216 North Broad Street, Philadelphia, Penn.

One of the principal objects of the manufacturers who have devoted special attention to what is known as service, has been to develop the agencies so that these could afford the same character of attention as the branches, and that all representatives should be able to do work practically as well as the factories having equipment, facilities and expert workmen trained in adjusting and restoring their particular productions.

Emphasis should be made that the branch or the agency of the progressive manufacturer must meet competition on a different basis than promising free repairs or parts or work, because these necessarily represent money that cannot be included in the purchase prices of the trucks, and if provided will reduce whatever profit may be made by either maker or his agent. When components and labor are supplied without cost to the owner, the manufacturer and his representative are responsible for every condition that

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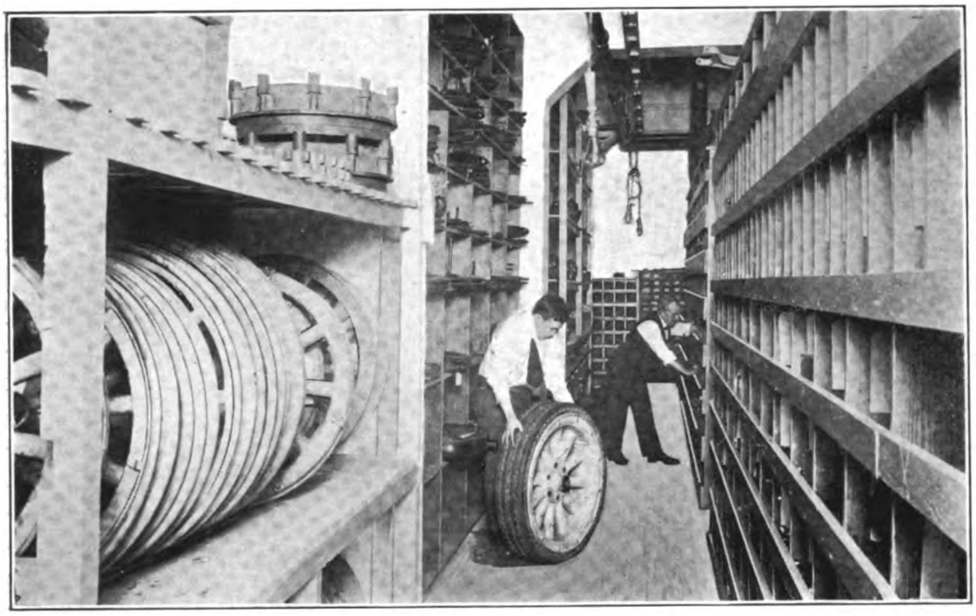


Section of the Stock Room of the Branch, Showing the Systematized Maintenance of Vehicle Components.

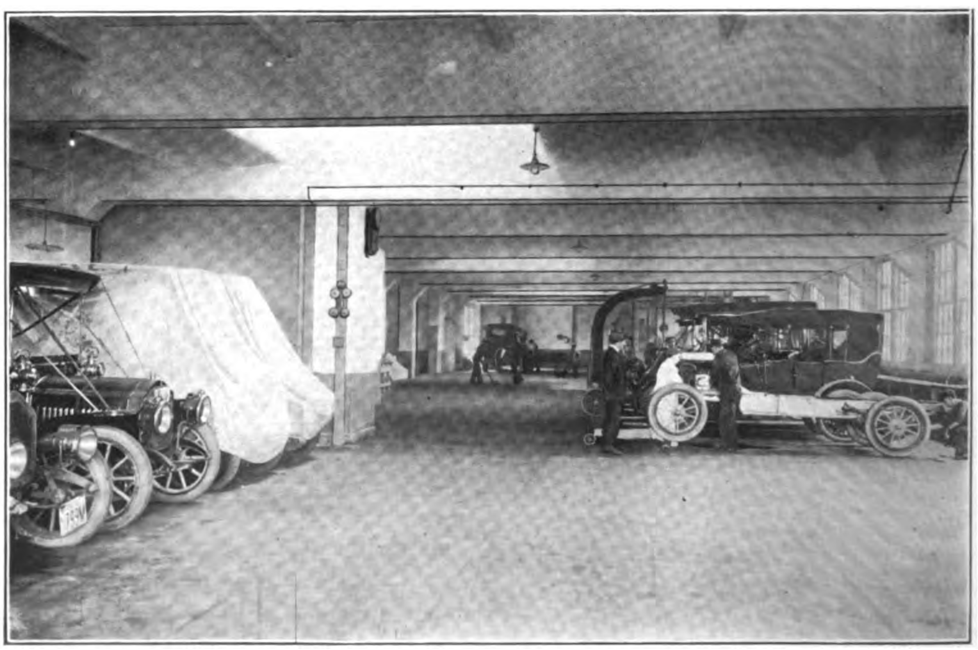
may eventuate, through ignorance, neglect or abuse, and they are held accountable for the operative value of the machines as well. These burdens could not be assumed unless the owners are willing to pay for service as though the vehicles were rented, and the prices were in ratio to the risks taken.

There is no good reason why a purchaser should expect from a truck manufacturer more than he will receive from the producer of any other type of machinery, yet without exception the different concerns of the industry have undertaken to give careful oversight and advise their customers, although they have in some instances defined their owner responsibilities closely and have adhered to them. Judging by experience generally there is good reason for the buyer to regard promises of unlimited attention with suspicion, because this would seemingly indicate lack of confidence in the machines, while at the other hand a well built vehicle, carefully designed and of good material, operated rationally, ought to endure for a long period and afford satisfactory service.

The necessity for a standard service policy has long been evident, and there is reason to believe that within a comparatively short time all of the large companies will adopt the recommendation of the National Automobile Chamber of Commerce with reference to what has been by common acceptance regarded as "service." Some of the large companies have organizations and methods that can be readily adapted to whatever policy may be standardized. Just to what extent "service" will go, and just what can be assured by uniform provisions, is uncertain, but there is no question whatever that each dealer will be required to keep stocks of parts that will be required through normal wear, will have workmen trained in adjusting and repairing the machines, and the owners of garages and repair shops remote from the branches and agencies will be educated and encouraged to specialize repairing these vehicles so that the owners will be assured that they can depend to the fullest extent upon them.

The manufacturers who have the most advanced methods adhere rigidly to the terms of the standard warranty, but through their branches and agencies they insure to the owners the highest standard of work and have methods that mean careful economy of stock and labor, so that the maintenance and adjusting is obtained at the least cost and with the minimum of lost service. Some have equipped their branches with special tools, so that any work can be undertaken and performed equally as well and as economical as at the factories, and they have systems of inspection of the machines that will inform the owners the exact condition of the vehicles at frequent intervals.

As the standard of mechanical efficiency is fixed and the desire of the manufacturer is that the owner should operate his equipment at lowest cost, there is



Portion of the Floor of the Station Devoted to Repairing, the Machine Shop Being at the Rear, in the Background of the Illustration.

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no reason for the owner to disregard reports that are obtained at considerable expense for his benefit alone. There may be supposition that the vehicle manufacturer desires to supply new parts because of the profit obtaining through their sale, but the business man must understand that the longer a machine endures, and the greater its operating economy, the more will other buyers be influenced by its service, and they would be correspondingly discouraged if it is expensive and unsatisfactory.

The facilities of some of the branches and service stations are surprising. With the stocks of parts and the tools and workmen, machines could be built quite equal to those produced by the factories. The departments are specialized in different works, and where time is money the owners' interests are carefully conserved. Not only this, wherever possible the garage owners and repairmen are given every assistance and induced to give attention to their machines in localities where the owners are remote from the service stations and branches. The policy of the White company is extremely progressive so far as the encouragement of the outside shops are concerned, for the company believes that every owner ought to have in the locality in which his machines are operated the White specialist, who can be depended upon for whatever service may be necessary, instead of relying wholly upon the branches or agencies or the factory.

Service of White Company.

The service afforded by the company through its branch at 216 North Broad street, Philadelphia, Penn., is typical of what is given by the White organization throughout the country, and the policy is reflected by the special effort to develop White specialists in the suburbs and the adjacent territory who can give a degree of service that has the approval of the company.

Through its travelling service men the White company has placed at the disposal of garages and repair shops the advice and service from men thoroughly trained in White methods. If an owner wants to train a man to work especially on White trucks he can send him to the branch, and there he will be given work in one department after the other until he has learned to adjust and operate trucks and is thoroughly capable. This applies equally well to White truck owners who may desire to install machine shops of their own, or who wish to train drivers or garage operators. Of course in such a case the wage of the workman while he is at the White plant is paid by the person or company that sends him there.

ROADMAN'S INSPECTION REPORT

THE WHITE COMPANY

Owner's Name——— Date——— 191—
Owner's Address——— Chassis No.———
Dealer's Name——— Engine No.———
Model——— Body——— Date of Last Inspection———

Compression Cylinder No. 1———	Radiator———
" " No. 2———	
" " No. 3———	Timing Gear———
" " No. 4———	
" " No. 5———	Steering Gear———
" " No. 6———	
	Clutch———
Valve Seating———	
	Clutch Trunnion———
Valve Adjustment———	
	Transmission———
Cylinders———	
	Gear Shifting———
Pistons———	
" Rings———	Foot Brakes———
Connection Rod Bearings upper———	Emergency Brakes———
" " " lower———	
Crank shaft Bearings———	Radius Rods———
Oiling System———	Differential and Gears———
Magneto———	Hub and Caps———
	General Condition———
Spark Plug———	Starter Motor———
Carburetor———	
General Lubrication———	Motor Clutch———
	Wiring———
Motor and Car kept clean?———	Battery———

General Condition
Driver { Competent or Not———
Overloading Truck?——— How Much?———
What speed truck run?——— Average daily mileage———
No. working hours———
Suggestions———

Signature———
Inspector

The Form on Which the Inspector Makes Monthly Report of the Condition of the Vehicles Within the Territory Served by the Branch.

The importance of good service to the truck owner in the sense of prompt attention to any repairs that may be needed and of their workmanlike completion, is very great. The pleasure car user is merely em-

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barrassed when his car is not serviceable, for after all the interruption is only of his pleasure. But the motor truck is the basis of delivery. It is the connecting link between the seller and the consumer. Its use represents value.

Service Vital to Business.

The best of salesmen, the finest of stocks and the most fascinating advertising are valueless to the business man unless the goods can be delivered to the purchaser on time and in good condition. The truck is the agency that accomplishes that delivery. When the truck is out of commission the entire business is tied up. Therefore service is imperative.

Authority for Repairs and Repair Sheet

THE WHITE COMPANY

Owner——— Repair Order No.———

Address——— M. O. Order No.———

Ship To——— Customer's Ref.———

Address——— Receiving Slip No.———

Charge——— Date Received———

Car or Part to be Repaired——— Date Shipped———

Transportation Charges——— Via———

I authorize you to make the following repairs, for which I agree to pay upon completion.

Signed———

For———Owner

	Repairman	Total Hrs.	Rate	Amount
1 FRONT AXLE AND STEERING GEAR				
2 MOTOR				
3 CARBURETOR, MAGNETO AND IGNITION SYSTEM				
4 TRANSMISSION AND CLUTCH				
5 REAR AXLE AND DIFFERENTIAL				
6 FRAME, SPRINGS, STRUT RODS, ETC.				
7 WHEELS AND BRAKES				
8 S. S. GENERATOR, WIRING BATTERY, ETC.				
9 EQUIPMENT				
10 MISCELLANEOUS.				

The Record That Authorizes Work and the Manner of Itemizing the Operations, Stock and Labor of the Job.

But good service, as the White Philadelphia branch sees it, is not a gratuity. Yet its scope is not simply confined to making repairs to a truck. It involves also keeping in touch with the working of the car, pointing out to the owner, driver or traffic superintendent, what can be done to safeguard the machine and get the best results from it.

In addition to the main branch there are garages in every city in the territory adjacent to Philadelphia that are being developed as White specialists and eventually—when the number of trucks in use makes it possible—there will be factory trained White experts in each of these cities.

The Philadelphia branch of the White company is housed in a magnificent building overlooking Broad street. The salesrooms are on the first floor, those in front being devoted to passenger cars, and in the rear to trucks. Behind this still is the inspection department and the garage. Entrance to the garage and service station is from Carlisle street, off Race. It is used for both passenger cars and trucks.

On the first floor next to the garage is the superintendent's office. His location permits him to keep in close touch not only with customers, but with all departments of the work under his direction. The first floor is used for giving service to customers, for making minor adjustments and for the storage of trucks in the garage. The garage is not, however, open to the public for the storage of vehicles.

Commercial cars are brought to the inspection department once a month for examination and minor repairs, such as can be made in half a day. As soon as the examination has been made the owner is notified in a letter from the inspector of the exact condition of his truck. This letter advises the owner of the adjustments made and informs him of which parts are so worn as to require immediate attention.

In addition to this inspection service at the garage a travelling inspector spends 15 days of every month in the city of Philadelphia and 15 days in the surrounding towns. He inspects each machine, except those inspected at the garage, once a month, and once in every three months he examines every White truck or car in the territory that is known to the branch. This includes second-hand cars and very old models.

On the mezzanine floor, which may be entered

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either from the service department at the rear or the magnificently furnished salesroom in front, are the branch offices, including those of the branch manager, sales manager and salesmen.

Back of the offices is an up-to-date paint shop, equipped both in material and tools and in men to turn out high-class work. On the third floor is the stock keeping department. This is very complete and is carefully arranged so that any part can be instantly obtained. The stock on hand is never allowed to fall below a minimum number that is based on probable demand for parts from customers. Parts for all models of cars that are now built or that have been built by the White company are stocked. Even components for White steamers can be had upon order.

The staff in charge of this important department is made up of a chief stock keeper and a number of helpers. Every week an inventory is taken that is sent to the Cleveland office of the company. Any shortage is immediately made up by shipments from there, and in this way the stock on hand is really controlled from Cleveland. Back of the stock room is a storage room for new cars.

The fourth floor is given over to a repair shop. This is equipped with a large number of automatic machines, including a 50-ton press, two drill presses, two lathes and a shaper. The equipment includes a large number of jigs and special small tools that have been built at the factory for special White work.

Saving Time in Service.

It is recognized that to save time is one of the most important functions of the service station, for every hour that a truck is out of service may be of serious consequence to its owner. Whenever a new job is given out workmen are notified five minutes in advance of the actual starting time, so that they may be able to get ready and stamp their time cards before beginning the work. Thus every minute for which the owner is charged is actually put upon the work for which he is paying. All the day and job cards are stamped with time clocks, so as to obviate any possible disputes. Every minute is accounted for and the record is kept with absolute accuracy.

In the repair department a specialist has been developed for every kind of work. There are, for example, men especially trained for work on steering gears, magnetos, carburetors and rear axles. In the motor department the work is further specialized, each man working on only one part of the motor.

The company has not hesitated to put as large an investment into equipment for the plant as can be used with economy in time and cost of repairs. The customer shares in any economies affected since he pays the same hourly rate for labor, although the job is accomplished in a shorter time.

When a machine is brought into the garage it is taken in hand by the man in charge of the garage. A record is made of the time the car was brought in. This is often valuable later in preventing petty disputes based on misinformation furnished by a driver to his employer concerning the time at which he delivered a machine for attention.

The vehicle is then turned over to the repair department foreman, who gives it to the tester. Under ordinary conditions it is possible to find out the exact condition of the car by a test on the floor, but if it is necessary a road test is given, so that when work is done the repairmen may have the most accurate data regarding its condition to guide them.

Report Made to Owner.

A complete report is also made to the owner. This includes, when desired, an estimate as to what the cost of the repairs will be. But a great many firms

REPAIR MEMO. SHEET

Owner——	Repair Order No.——
Address——	M. O. Order No.——
Ship To——	Customer's Ref.——
Address——	Receiving Slip No.——
Charge——	Date Received——
Car or Part to Be Repaired——	Date Shipped——
Transportation Charges——	Via——

1 FRONT AXLE AND STEERING GEAR

2 MOTOR

3 CARBURETOR, MAGNETO AND IGNITION SYSTEM

4 TRANSMISSION AND CLUTCH

5 REAR AXLE AND DIFFERENTIAL

6 FRAME, SPRINGS, STRUT RODS, ETC.

7 WHEELS AND BRAKES

8 S. S. GENERATOR, WIRING BATTERY, ETC.

9 EQUIPMENT

10 MISCELLANEOUS

Date Completed—— Foreman——

Repair Memorandum, on Which Is Recorded the Work to Be Done and Detail of the Order.

who have been dealing with the branch for a long time and know its methods do not ask for such advance estimates.

Meantime a repair tag has been made out in duplicate. One is retained in the repair shop and the other is turned over to the customer. If the job is to be completely overhauled the body is removed from the chassis and turned over to the painting department. In this way it is possible to have the body paint dry by the time the chassis repairs have been completed.

The work is then assigned to the shop foreman. The engine is taken out and removed to the machine shop, the wheels are taken off and the rear axle steer-

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ing gear, radiator and transmission gearset are all turned over to different specialists. The floor crew gives attention to the frame, springs and front axle. In cases where riveting is necessary pneumatic hammers are available for the work. If compressed air is wanted it is obtained from various leads located throughout the building.

Sanitation and the comfort of the workmen have been taken into consideration in the arrangement of the repair department. An excellent system of ventilation has been installed. There is ample room for the workmen on all the repair work that is likely to develop at one time and the freedom of movement, made possible by the spacious quarters, influences reducing the labor cost on the work.

Extreme care is taken to guard the stock and supplies. Nothing can be secured without a requisition which has been signed by the foreman in charge of the work and presented to the head of the stock department. This shows who authorized the use of the part and it is easy later to determine whether or not it was necessary.

TIME CARD

Time Started | Time Finished

Repairman ....

Job No. ....

TOTAL
Hours Minutes

Name of Owner ....

WORK DONE

Approved .... Foreman

Time Card, on Which the Work Is Specified and the Time Is Stamped by Clocks to Insure Against Error.

Supplies of any kind are charged to the men obtaining them, and also against the job. Responsibility is thus established and if there has been any waste the offender can be called to account. Moreover, the stock charges can be consulted in making up the bill for the owner of the car.

How Repair Sheet Is Made Up.

The repair sheet is made up from the time cards of the men, stamped with the time of beginning and ending work on the job, from requisitions sent to the parts department, from stock charges, etc.

The owner has the privilege of sending a new driver to the White branch, where the superintendent puts him at work as helper to a skilled workman and he is taught every detail of the construction of White trucks thoroughly.

When driving instructions are given the novice is put in charge of a trained driver, who drills him in all the routine operations, such as lubricating, tank filling, washing, etc. All conditions and contingencies that may effect the successful use of the truck are care-

SHOP REPAIRS REQUISITION

REPAIR CARD NO....... DATE................ NO......

FOR WHOM..

Quan.	Part No.	Name

SIGNED.................................
Foreman

Repair Shop Requisition, with Which All Material Used for Work Is Withdrawn from Stock and Authorized by the Foreman.

fully explained to him, and every probable exigency that may eventuate in the operation of the truck is forecasted.

Through this careful training the White company has developed many skillful drivers from men who formerly drove horses, so that the owners have the services of dependable men who know the owners' businesses and customers, and who are familiar with street conditions and traffic.

All these carefully developed facilities are at the command of the White truck owner day and night and seven days a week, so there is never a time when prompt attention to White trucks cannot be secured from the branch in the shortest possible time.

The branch charges its customers practically cost for the use of trucks that are used to replace their own while these are undergoing repairs. It charges from $1.50 to $3 a day for wheel rental, while it supplies without charge some parts for emergency use on which the depreciation is likely to be slight.

It charges electric storage batteries for its customers and is in a position to carry out for them any work that may be desired upon their trucks. It does not make monthly maintenance contracts with truck users, but charges for each job separately.

The Sternberg Motor Truck Company, originally incorporated as the Sternberg Manufacturing Company of Milwaukee, Wis., has again changed its name to the Sterling Motor Truck Company. This is to conform with the name "Sterling" that has been adoped for the trucks.

SHOP REPAIRS CREDIT

REPAIR CARD NO....... DATE................ NO......

FOR WHOM..

Quan.	Part No.	Name

SIGNED.................................
Foreman

Shop Repairs Credit, with Which Unused Material Is Returned to Stock and the Company Safeguarded Against Waste.

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NEW GOODRICH TIRE POLICY.

New recommendations as to the sizes of truck tires to be used have been issued by S. V. Norton, manager of the truck tire department of the B. F. Goodrich Company. The company now recommends the use of five and six-inch single tires in preference to three and 3½-inch duals. But where conditions demand seven-inch single tires or larger it is best to use four, five or six-inch duals.

"Momentary overloading in which a tire or part of tire is called upon to stand a pressure that breaks it down so badly that it cannot recover is the cause of more damage to tires than any other thing," says Mr. Norton.

"In the smaller sizes of dual tires, less than four inches wide, neither tire is large enough to bear the whole load successfully when conditions exist that throw it all on the one tire. Something approaching this condition occurs on crowned roads where the curve in the surface places more of the load on the inside tire than on the outside.

"The objection to sizes larger than seven inches wide is that internal friction gives rise to heat, which is not readily radiated from so large a tire. This may result in permanent damage."

The advantages of single to dual tires are summed up as being a saving in tire first cost, saving in wheel cost due to narrower felloe, narrower band and other changes in wheel design; saving in the unsprung weight of the wheel; saving in labor for applying one tire to wheel as against applying two; larger tire units better absorb inequalities in the road, and better compensate for slant of the road crown; they are more readily fitted with non-skid chains; better trackage of rear with front wheels; greater height of rubber tread and therefore greater life; less leverage strain on axle and bearings because of narrower width.

Mr. Norton believes it is an error to rate a dual tire higher than twice the rating of the single tires of which it is composed.

BALTIMORE LIMITS TRUCK WEIGHT.

An ordinance has been passed by the Baltimore, Md., city council forbidding any truck weighing more than 12,000 pounds with load to pass over the city bridges, and the owner of any truck that weighs more than 14,000 pounds must obtain the permission of the city engineer for it to be driven through the streets of the municipality.

ONE-TON PALMER-MOORE TRUCK.

Larger Machine Built to the Standardized Design Widely Known.

The Palmer-Moore Company, Syracuse, N. Y., builder of Palmer-Moore light trucks, which for several years specialized the production of a machine of 1600 pounds capacity, has begun the manufacture of a truck of 2000 pounds capacity which has somewhat increased dimensions, but which is in accordance with the design of the smaller vehicles, which has been proven by service to be extremely satisfactory.

One of the characteristics of the Palmer-Moore trucks is the engine, which is a two-cycle, three-cylinder type, either air or water cooled, the water cooled motor with thermo-syphon circulation being the standard product. The machine in all other respects is constructed to conventional practise. One of the claims made for the trucks is extreme economy and efficiency, and the statement is made that the 2000-pound machines will be equally economical and efficient.

The Latest Palmer-Moore Production, a Larger and Heavier Built Truck, Having Load Capacity of 2000 Pounds.

The new model is considerably larger and somewhat heavier in general construction than the 1600-pound type, and is designed to meet a demand for a medium capacity truck that has unusual strength and capacity for bulk load without materially increasing the operating cost.

The wheelbase of the 2000-pound truck is 126 inches and the chassis has body equipment that is 120 inches length inside measurement. The motor is the same type used in the smaller vehicles, but the frame is longer and the springs, axles, wheels, chains and sprockets are heavier. The wheels are equipped with four-inch tires on the rear and 3½-inch tires on front.

The accompanying illustration is one of the first chassis turned out, which was purchased by the city of Syracuse, N. Y., for use as an emergency wagon, and on this is installed a standard open express body with a permanent cab over the driver's seat. It is in the service of the department of public works. The equipment includes electric headlights and a hub odometer

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for one of the front wheels. Since delivery the machine has given excellent satisfaction. These chassis are equipped with different standard bodies to the order of the purchaser.

KISSELKAR BUSINESS LARGE.

The Kissel Motor Car Company has this year experienced a large increase in business in every part of the country and particularly in the large city markets, according to G. C. Frey, sales manager. The demand in New York, Chicago, Boston and Philadelphia has been unexpectedly large and Minneapolis, St. Paul and Milwaukee, where many KisselKars are in service, have taken unprecedented numbers. Much of the production has gone to the Pacific Coast and the agricultural districts of the West. All estimates on 1915 production have been upset and thè company will dispose of every car that it can build during the selling year.

The company has municipal service trucks in upward of 50 cities. These include motor driven fire apparatus, street sprinklers and flushers, police patrols, ambulances, water department fleets, waste pick-ups and dump wagons. Recent purchases have been made by Council Bluffs, Ia.; Duluth, Minn.; Butte, Mont.; Vallejo and Riverside, Cal.; Alliance, Neb., and Sheboygan, Wis.

GOODYEAR TRUCK PNEUMATICS.

Special size pneumatic tires for use on trucks are now produced by the Goodyear Tire and Rubber Company of Akron, O. These tires are specially designed for machines which carry glassware or other fragile material in which the cushioning effect of pneumatics is desirable. They are not expected to yield a mileage equal to solid tires. A considerable outlet for such tires is developing for sightseeing 'buses where easy riding is demanded, and on fire apparatus which must travel at high speed.

These tires can be easily changed in a few minutes anywhere. They are built like the smaller Goodyear pneumatics except that the side walls contain extra plies of stout fabric and the treads of tough rubber are double thick to preclude the possibility of ordinary punctures. The use of these tires is said to cut truck repair bills 70 per cent. because vibration is deadened and the mechanism more fully protected.

KELLY-SPRINGFIELD APPOINTMENTS.

Announcement is made by James L. Geddes, president of the Kelly-Springfield Motor Truck Company, Springfield, O., that Walter C. Guilder has been appointed factory manager in charge of production. Mr. Guilder has had a long experience in this work, having been for several years in that capacity with the Mack Motor Truck Company at Allentown, Penn. Before taking his present positon he was with the Timken-Detroit Axle Company. Louis P. Kalb has been appointed engineer. He is a graduate of Cornell with an M. E. degree and was for 3½ years with the Pierce-Arrow Motor Car Company in various capacities. C. F. Gardner has been appointed assistant to the president. He was formerly with the Remy Electric Company of Anderson, Ind., and with the Stoddard-Dayton Motor Car Company of Dayton, O.

AMERICAN TRUCKS LONDON 'BUSES.

A year ago it would have seemed impossible that American trucks chassis should be used for motor 'bus service in London streets. But recently 30 American trucks were purchased by the Great Western Railway of England and are now operated in London. The trucks are an internal gear type and have passed the tests provided by Scotland yard to assure quietness of operation.

The London regulations for 'buses are the strictest in the world, especially with regard to noise. Because of noise the side chain drive has been banned. English manufacturers have developed a type of shaft drive to meet the conditions. Internal gear drive is favored on the continent and the introduction of American trucks of that type may affect the English builders.

NEW CONCERN SELLS KNOX TRACTORS.

A new company entirely separate from the producing organization has been formed to market Knox tractors and other Knox products. It is known as the Knox Motor Associates and will hereafter handle advertising as well as sales.

The officers of the company are: President, H. G. Fisk; secretary, C. H. Beckwith; treasurer and general manager, E. O. Sutton. During the past year the company has developed a new four-wheeled tractor, which is especially adapted to hauling heavy materials such as lumber and structural iron. There is a growing demand for the detachable power plant of the tractor type, and an energetic campaign will be conducted for that market.

AUTOS AT BIG WHEAT SHOW.

A feature of the International Wheat show to be held in Wichita, Kan., Oct. 4 to 14, will be a display of automobiles and trucks arranged by the Wichita automobile dealers. Every automobile dealer and accessory distributor in the territory is interested in the plan and every inch of the 8800 square feet of floor space that is available has been taken. The cars will be seen by 150,000 well-to-do Kansas and Oklahoma farmers. Practically all the standard makes will be displayed.

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PRACTICAL MOTOR TRUCK MECHANICS.

A wood vise, such as is common in private garages, may be easily converted into a vise for holding metal pieces. Obtain an old 12-inch fine file, heat it and allow it to cool. It should then be cut so that two jaws may be secured. Two holes can then be drilled and countersunk. Now cut a recess in the wooden jaws of the vise with a chisel, a little less in width than the file. The pieces of file can then be hardened if desired and attached to the wood vise as illustrated in Fig. 19 A.

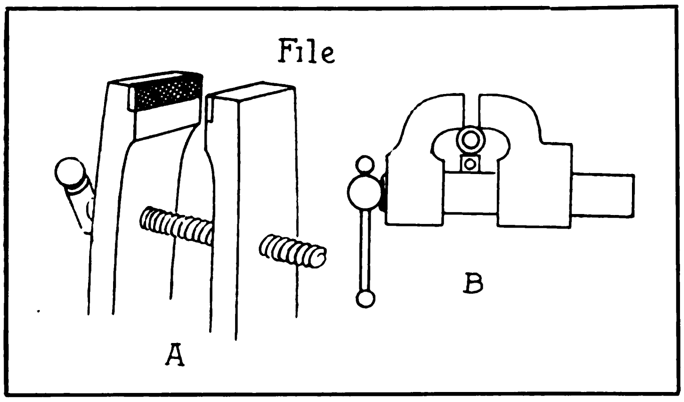

Fig. 19—A, Metal-Holding Jaws Fitted to Wood Vise; B, Method of Holding Round Material in an Ordinary Bench Vise.

EASILY MADE PIPE VISE.

A smooth pipe or rod may be firmly held without denting in a smooth jawed vise by the following method. Obtain a square nut or other stock of the right size and place it on the arm of the vise as shown in Fig. 19 B. The article to be held should be placed on the nut and when the jaws of the vise are brought closer together, the lower corners will grip the piece. This method of gripping will not mark the surface and will securely hold smooth, round articles.

SILENCING NOISY RIMS.

When trucks are equipped with demountable rims one may note an annoying sound at each revolution of a wheel. The noise may cause the motorist to believe that the spokes of the wheel are loose. The trouble is generally to be located in the bolts which retain the rim to the wheel. The wear is usually the result of running with the bolts too loose and the only proper remedy is to replace the old bolts with new. A temporary remedy for this trouble, however, may be easily effected by loosening the bolts and inserting a small piece of leather between the wedge and demountable rim, as shown in Fig. 20 A.

REPAIR OF OLD TIRE CASINGS.

Tires much worn in a section, in condition that does not warrant repair by an expert or an adjustment with the maker, may frequently be repaired by the owner so that a few hundred miles of service may be obtained. Carefully clean the inside of the casing with gasoline for about six inches on either side of the blowout. From an old tire which cannot be repaired, cut a good section about 12 inches long and cut off the bead as shown in Fig. 20 B. Clean the outside of the patch with gasoline and trim the sharp edges to a feather shape. Apply three separate coats of cement to the inside of the casing and to the outside of the patch and when dry combine the two pieces after the same manner as a common tube patch. Small holes can now be punched through the casing and the patch and small copper rivets inserted, as shown in Fig. 20 B. A smooth piece of canvas should then be cemented to the patch to insure the inner tube against sharp edges and from being pinched.

POLARITY DETECTOR.

Several methods may be used to determine the polarity of electric wires, but a very simple, yet accurate detector, is made by immersing a piece of white filter paper in a solution of sodium sulphate, to which has been added a small quantity of phenol phthalein. If the paper is touched while wet with the negative wire, a violet color appears, but when touched with the positive wire there is no change in color. Filter paper treated in this manner is sensitive to very feeble currents. Blue print paper can also be used for the same purpose. If touched with the negative wire, a white spot will develop, but the positive wire has no effect upon the color.

CHANGING TRUCK SPEEDS.

With many large trucks it is extremely difficult to reduce the gears of the transmission gearset to get slower speed. To force a slower moving gear into mesh with a faster moving one causes noise, and generally serious wear on the gears and shaft bearings. This clashing can be avoided by rapidly kicking the

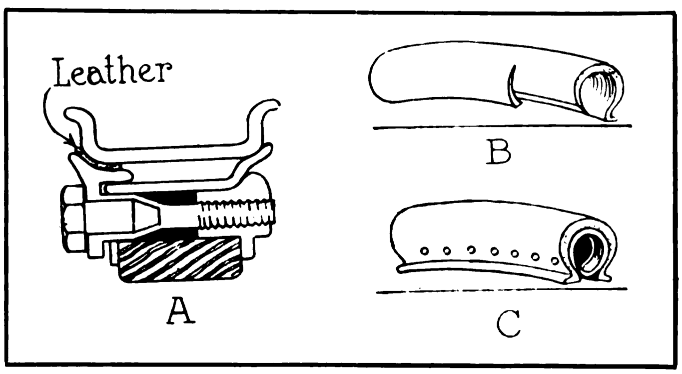

Fig. 20—A, Silencing Noisy Tire Rim with Leather Strips; B, Tire Section Trimmed for Fitting to Shoe; C, Section Cemented and Riveted in Place.

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clutch twice. For example, if a car is climbing a hill at high speed and it is necessary to shift to the next speed lower, this change could be made in the following manner: Throttle the motor and throw out the clutch, and then place the speed lever in neutral. With great rapidity let the clutch in and push it out again. This kick slows the gears of transmission to the slow turning of the motor and the result is that the two sets of gears will be revolving at approximately the same speed and the changing can be made easily and noiselessly. It should be distinctly understood that this double kicking must be done correctly, and quickly, because the momentum of the car must not be lost.

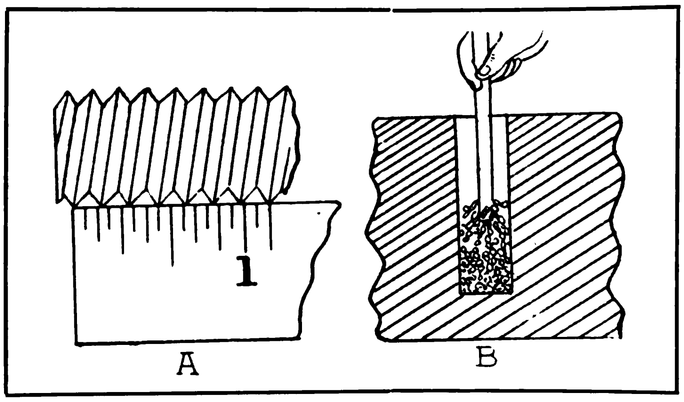

Fig. 21—A, Handy Method of Determining Thread Pitch with a Rule; B, Removing Metal Chips with a Magnetized Rod.

MEASURING SCREW THREADS.

When determination of the pitch of a screw is necessary and a thread gauge is not to be had a scale may be placed on the screw as illustrated in Fig. 21 A. The end of the scale should be opposite the top point of any thread and the spaces counted under the scale between the threads for one inch. If there are eight spaces within the inch, for instance, the screw is eighth-inch pitch, or has eight threads to the inch.

REMOVING METAL CHIPS.

It is frequently found necessary to drill some stationary part of a machine. If the hole is to be used for the entire depth and has not been drilled completely through the part, removing the metal chips may be difficult. Nothing can be found handier for this operation than a small magnetized rod or tool. Simply insert the rod in the hole and when removed some chips will adhere to its surface, as shown in Fig. 21 B. A small rod or tool may be easily magnetized by placing on a charged plate.

HOME MADE SMALL JACKS.

Small jacks are very useful equipment for any repair shop or garage. A jack similar to that shown in Fig. 22 A can be easily made in the following manner. Obtain a fairly large size bolt having a hexagon head. Cut off the threaded end and file the surface flat, and drill and tap a hole through its centre for the entire length. The screw can be a part of an old clamp having a swivel head, as shown in Fig. 22 B, or it can be made from a smaller bolt, the head being filed to a point, as shown in Fig. 22 C. For convenience of turning, small holes may be drilled through the top of the screw to receive a small rod.

REMOVING BROKEN SCREWS AND BOLTS.

The removal of broken screws and bolts is sometimes difficult work. A common method employed is the striking of a small chisel at the edges of the broken part. While this operation may be successful, it is not advised, as the threads of the hole may be damaged. A better and more workmanlike way is to drill a small hole in the stub and then drive a tapered four-sided punch into it, as shown in Fig. 22 D. The punch head can then be gripped with a small wrench and the punch and the broken screw removed as a unit.

ANGLE DROP LIGHT.

It is often necessary to direct the rays of an electric drop light in a particular place so that they will illuminate an object upon which work is to be done. The light may be tilted in any desired direction by attaching a small piece of string to the cable and a small hook made of wire secured to the other end of the string and fitted to the rim of the shade, as illustrated in Fig. 23 B. The string may be lengthened or shortened according to the angle desired. The light may be cast in any direction by moving the hook around the rim.

SAFELY LOCATED SWITCH.

In garages where working space is limited, it is a dangerous practise to install an electric switch on the side walls, as contact with a piece of metal may cause injury to a workman. Usually a fitting similar to that shown in Fig. 23 A can be made. Install the switch on the ceiling and at a point directly over the handle

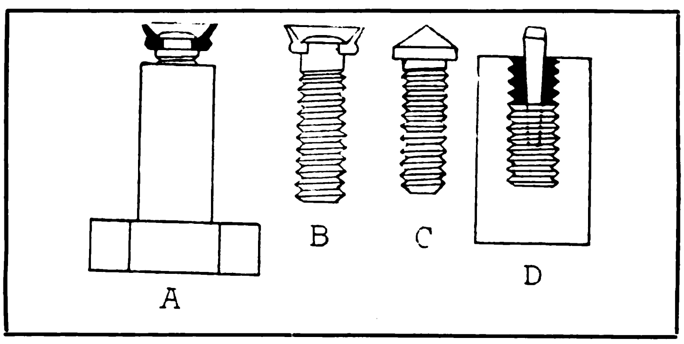

Fig. 22—A, B and C, Forms of Small Jacks for General Use; D, Suggestion for Removing Broken Bolts and Studs from Holes.

and on the ceiling, secure a small block or hook. With a sharp knife cut a small groove around the handle of the switch and then attach a strong cord, taking care

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that both ends are left quite long. Pass one end of the cord through the block and allow the other end to hang free. At a convenient reaching distance the cords

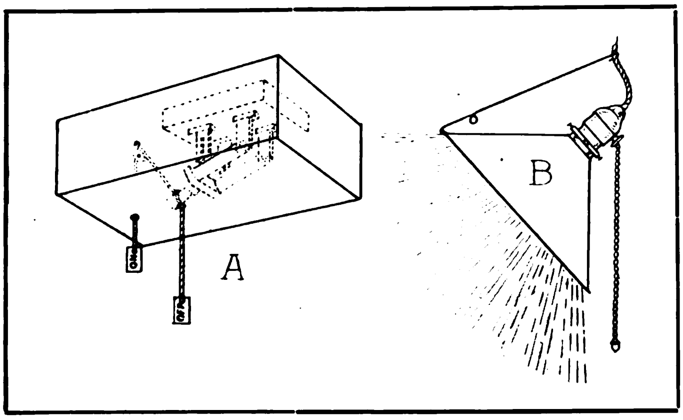

Fig. 23—A, Practical Guarding of an Electric Circuit Switch; B, Manner of Holding a Drop Light at an Angle.

may be cut and a small tag marked "on" attached to the string passed through the block and a tag marked "off" placed on the free cord. If necessary the switch may be enclosed in a wood box, small holes being made for the cords to pass through, as shown in the sketch.

METHOD OF TEMPERING LATHE TOOLS.

Several methods of tempering lathe tools are extensively used, but one of the best is as follows: Take an inside boring tool similar to that shown in Fig. 24 A and heat it to the proper hardening temper to about a half inch from the cutting edge. Then plunge the entire tool, cutting edge down, into a bath. The tool should then be polished with emery cloth as far back as X. Next heat a pair of blacksmith tongs to a white heat and grip the tool just behind the line. The hot tongs will draw the temper evenly. The temper should be drawn to a light blue and the part instantly cooled in a bath of cold water containing salt. Of course the size of the tongs used will depend upon the size of the tool.

COMPRESSING VALVE SPRINGS.

After grinding the valves of large motors, it is many times found to be a difficult task to replace the valve springs. An easy and practical method is to place the spring lengthwise in a vise and gradually tighten it until it is fully compressed. Run two strong pieces of cord through the coils and fasten securely. Rmove from the vise and adjust to the valve in the usual manner. When everything is set the spring may be released by cutting the cord with a knife.

BORING HOLES IN GLASS.

There are many methods of making holes in plate glass, but one of the simplest which can be successfully accomplished by any motorist is illustrated in Fig. 24 B. Obtain a three-cornered file, the same size as the hole desired, and grind the edges and the point. The file can now be placed in an ordinary carpenter's stock. Place a piece of cloth or waste on the bench and lay the glass on it. A putty mold should now be formed around the part to be drilled and the centre filled with turpentine. The hole can now be drilled in the ordinary way, using but slight pressure on the tool. It is imperative that the point of the file be kept moist with the turpentine.

INSERTING SPARK PLUGS.

Metal will expand to a certain extent when subjected to heat. Frequently the removal of spark plugs is extremely difficult, and the cause was that the cold plug was tightly screwed into a hot cylinder. When the plug and cylinder become hot, both expand equally, causing an extremely tight fit. One should fairly seat the cold plug in the hot cylinder, and when the plug is hot it may be securely tightened. Or the plug may be seated fully when the cylinder is cold.

EMERGENCY FUNNEL.

Frequently when on the road a funnel is necessary to pour a fluid into some part of the machine. In such exigencies the ordinary hand horn will serve as a practical substitute. Simply disconnect the horn and remove the reed, and after cleaning it will serve admirably.

TO DRILL TEMPERED STEEL.

Removing a broken tap from a hole is not an easy operation and generally the most practical method is drilling. Usually the tap must be annealed before drilling, but if the cutting edge of the drill and the

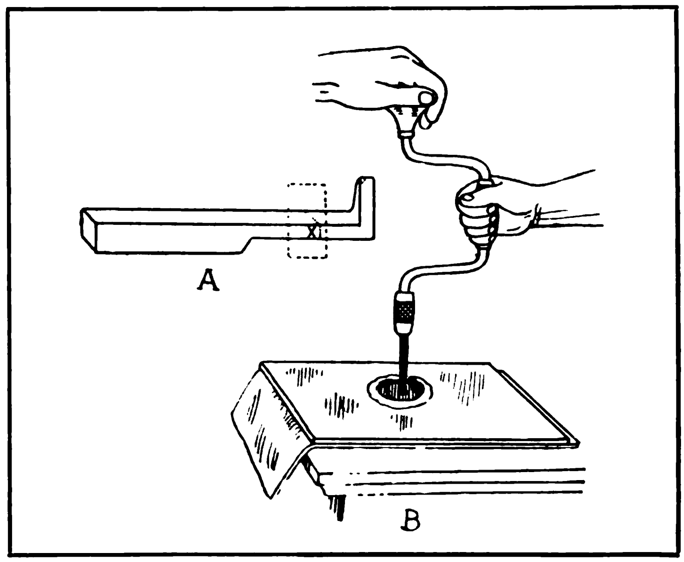

Fig. 24—A, Method of Tempering Small Metal Parts; B, Boring Glass with Improvised Tools.

tap be kept wet with spirits of turpentine the drill will cut freely, although without this lubricant the cutting edge would simply wear off.

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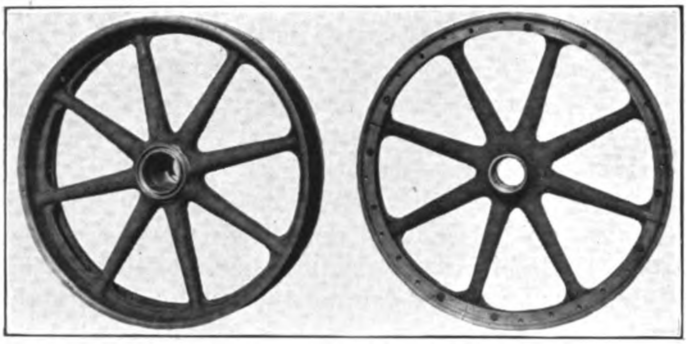
ESCO DETACHABLE STEEL TRUCK WHEELS.

STEEL wheels have been used by several builders of motor trucks in America, but in Europe, and particularly in England, where the supply of suitable wood for wheel construction is limited and costly, there is a much more general use of such equipment. These wheels have been built of several types, with solid spokes and rims, cored spokes and solid rims, cored spokes and rims, and built-up wheels in which the spokes and rims are constructed of steel stampings riveted together. In this country steel wheels have been cast with solid spokes and rims, with cored spokes and solid rims, and with cored spokes and rims, and malleable iron has also been used.



Esco Steel Wheels with Detachable Rim Designed for Use on the Front Axles of Trucks, Showing Both Sides.

The White Company and the Locomobile Company of America have used steel wheels as standard equipment, these being constructed to their own designs for several years with considerable success. Several firms in the United States are agents for imported steel wheels, but these are seldom installed by owners. In view of the considerable number of trucks that are now being built for export, and the more general use of steel wheels abroad, there is reason to believe that machines intended for industrial service in Europe would be more favored as against European built vehicles if they were fitted with this equipment.

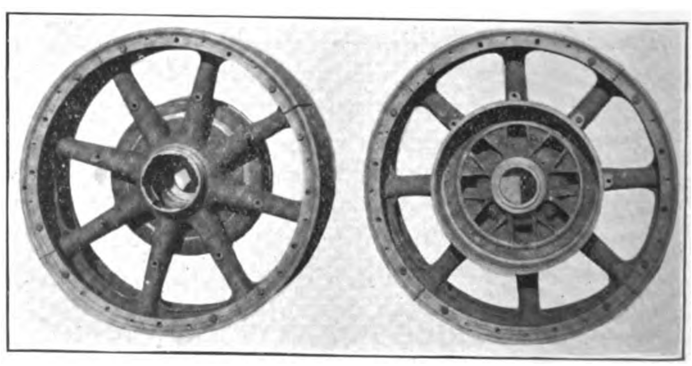
The Electric Steel Castings Company, Ltd., Sheffield, England, agent for the George Fischer Electric Steel Works of Switzerland, is now supplying a type of steel wheel having a detachable rim, considerable numbers of which are used by two manufacturers who are producing machines exclusively for the English war department. The claims are made that with this equipment the purchase of spare wheels is unnecessary; that the changes of rims can be made by the driver in very short time; that tires can be reversed to equalize wear without expense or loss of time; tires can be placed on rims without material delays; that wheel adjustments after tire changes are not necessary, and there is greater tire economy.

The wheels are built for both forward and rear axles, and have been given the trade name of Esco. They are designed for all types of solid or pneumatic tires that can be used with steel or metal base or band, and the principle of construction does not differ materially from several makes of demountable rims that are built in this country. These wheels are cast with circular spokes and with rims that have considerable taper. At the largest circumference of the rim is an external flange that is integral with the rim, and which is the seat of the rim or band that carries the rubber tire. At the other side of the rim is an internal flange that is of considerable depth, the outside edge of which is approximately even with the outside edge of the tire.

When the tire is applied it will be a loose fit on the rim when seated against the external flange. The space between the taper rim and the tire band is partly filled by a number of segments that conform to the contour of the rim and are in effect sections carrying wedges that are forced between the rim and the tire band, having flanges to correspond with the external and internal flanges of the wheel rim. The internal flanges of the segments are drawn to and seated against the internal flange of the wheel by heavy bolts, so that the tire is held rigidly. The nuts of the bolts are inside of the rim of the wheels, fitted with dual tires, and on the inside of the wheels for front tires, so that the nuts may not be sheered or the bolts bent should the wheel be driven so as to contact with the curb. Tightening the nuts will wedge the tire firmly and the nuts can be quickly loosened should there be need, for when one segment is removed the pressure is sufficiently diminished so that the others can be easily taken off.

EXPLOSION PROOF MINING MOTORS.

In experiments to determine methods of lessening danger from the use of electricity in the mining industries, the United States Bureau of Mines has discovered a successful explosion proof motor for work in mines where gas and coal dust if ignited by an electric spark might cause a disastrous explosion. A description and specifications for such motors can be secured by applying to the bureau, as well as a detailed description of the tests which the motor has undergone.



Esco Steel Rear Wheels for Trucks with Detachable Rims, the Rim Locking Segments Being Attached.

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NATION'S NEED OF MOTOR ARMY TRANSPORT.

Successful Use of American Trucks in European Warfare Proves the Usefulness of These Types, But Special Constructions and Equipment Are Absolutely Necessary.

IT IS generally understood that as a result of its observance of the use of motor vehicles in the European war the United States army will shortly begin the modernization of its transport wing by large purchases of motor equipment.

Certainly the logic of the situation demands such a step. At present the American army has practically no motor transport, but in case of a war would have to depend upon mules and horses or what it could buy in the open market. Neither has the government subsidized private truck operators to secure the use of trucks that come up to military requirements so that they may be taken over in the event of war. There is no law that will authorize the commandeering of private property for government use, no matter what the need.

European experience so far has shown that the motor vehicle constitutes the backbone of the modern army. Without it either of the contenders on the western front, particularly, would be helpless. All doubts as to whether the motor has reached a sufficient development to be dependable and efficient in war have been removed.

Furthermore, the performance of American trucks in the service of the various armies makes it plain that they are equal in every way to the best trucks produced elsewhere.

Study in detail of the methods used in Europe and the results obtained will probably dictate the type of motor vehicles to be adopted and the specifications approved for the various types, the degree of standardization required and other matters of that sort.

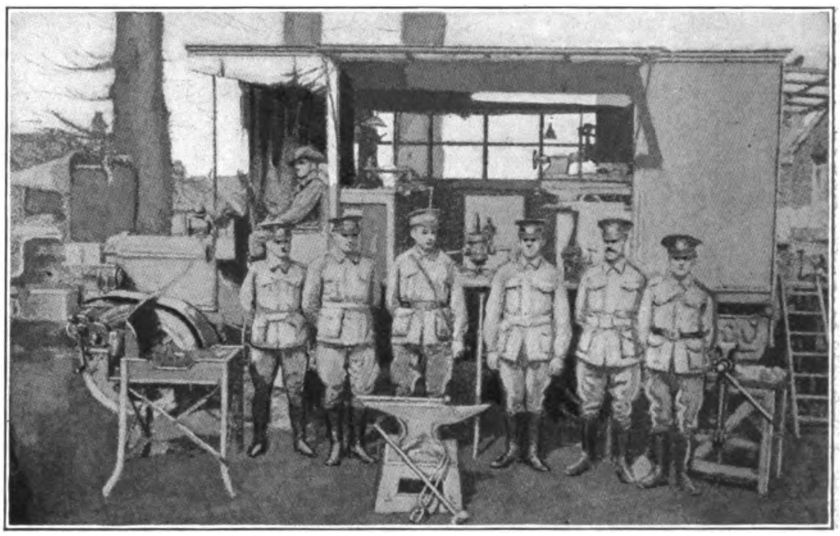
Before the war the armies of the various belligerents had made a careful study of trucks and had adopted more or less standardized specifications which any truck accepted for military service must meet. Commercial owners who used those types of trucks and held them in readiness for war service were placed under subsidy.

Subsidized Trucks Very Few.

The development of the truck, however, had been so recent and so little time had elapsed since the adoption of the standards that not many trucks built to the specifications were available. Even had the regular armies been completely equipped with them and a considerable number had been in reserve they would have not been sufficient in number to serve the extra demands brought about by the calling of vast numbers of reserves and of volunteers to the colors.

This situation made it necessary for the governments to abandon their standardized specifications and to accept for service practically any truck that would run. This in itself proved to be a considerable disadvantage. The field repair shops, to accomplish quick and effective service, must be equipped with ample quantities of spare parts for the trucks in use and the multiplication of designs has made the variety of these parts necessary staggering in number and added greatly to the impedimenta of the various armies.

To some extent this has been overcome by standardizing large fleets serving different portions of the line with trucks of the same make and model, so that each service station at the base need have only complete assortments of parts for from one to three or four makes of trucks.



Field Motor Truck Repair Shop and Some of Its Facilities, Attached to the Australian Corps of the English Army.

Standards for United States Army.

This illustrates the necessity of standardization, and it is quite probable that when the United States army authorities take up the motor vehicle problem in earnest, set specifications for all trucks to be used for certain purposes will be adopted.

The marked preference shown recently by army officers in their few purchases for trucks of the four-wheel drive type make it more than possible that machines of that design will be adopted for heavy hauling in the field.

Among the vehicles that have afforded very efficient service in the war to date, in addition to transport trucks, are caterpillar drive tractors for heavy guns, armored motor cars mounting machine guns or

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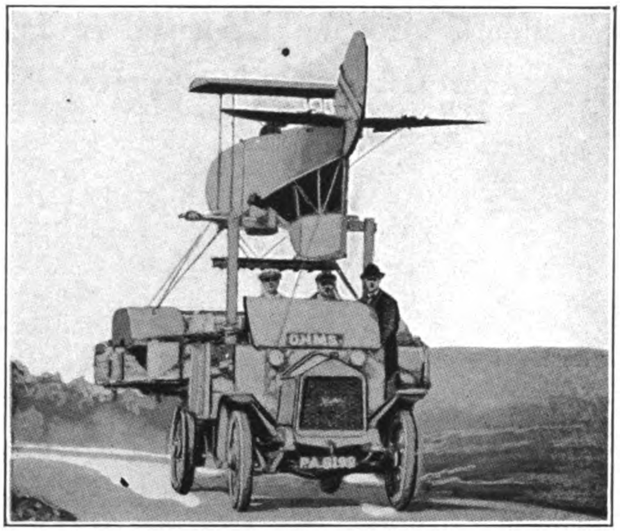
light artillery, motor ambulances, officers' cars—not different from the ordinary touring car—surgical and hospital units, motor kitchens, aeroplane transports,



Truck Adapted for the Transportation of English Army Aeroplanes and Navy Seaplanes.

cars mounting searchlights for use in the trenches, motor machine shops for field service stations, trucks carrying various elevating devices for artillery observers, veterinary ambulances for the transportation of injured horses, and tank wagons for fuel and oil supply.

Tractors for moving heavy artillery, such as those that were employed by the Germans to take their 42-centimeter guns into Belgium, are very heavy and of special design. The caterpillar drive is regarded as the only certain method of propulsion for motors of power sufficient to move a gun weighing many tons, for this type can be operated on soft ground with reasonable efficiency.

Armored cars mounting machine guns are usually constructed on a heavy type of touring car chassis that can be driven at high speed. The bodies are completely enclosed in steel armor, behind which the guns are mounted. They carry crews of five or six men. In the early movements of the present war such cars in many instances replaced cavalry.

Motor ambulances are mounted on heavy passenger car chassis and do not differ materially from the police and hospital ambulances used in most American cities. Some of them provide space for as many as six stretchers.

Good, durable, high-powered passenger cars of any type are suitable for carrying officers from point to point in the battle lines.

Differing Hospital Equipment.

There is more variety in the surgical and hospital units. These are often mounted on truck chassis and sometimes are used in groups of from two to a half dozen, each truck carrying part of the equipment for a field hospital, to be set up a short distance behind the fighting line.

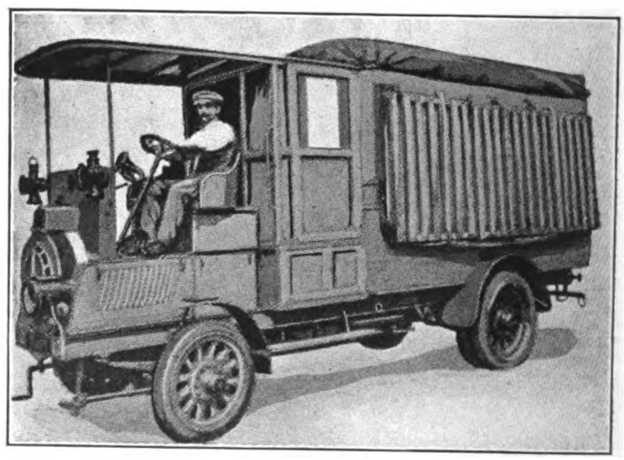
In such a group one truck may carry an operating room with complete surgical equipment, including electric lights and provision for supplying hot water. They may have an X-ray outfit, power for the light being generated by the truck motor. Then there are water sterilizing outfits mounted on trucks and motor baths. These carry large supplies of water along with collapsible bath tubs for the use of the wounded. One of the hospital units is usually a motor field kitchen. This contains lockers and bins for food supplies, hot water tanks, compact kerosene cooking stoves and all essentials for preparing food. Other trucks may transport the hospital pharmacy, tents, beds, chairs and other equipment of the sort. Many of these motor hospitals are the most novel motor productions the war has brought forth. The designs used in Europe doubtless offer great opportunities for further development.

Special Observation Outfits.

Army aeroplanes are arranged so that the wings and parts of the body of the machine may be quickly removed, so that they may be loaded on trucks for rapid transport to another part of the line. Trucks used for this purpose are quite ordinary tractor chassis of more than average speed which want trailers with van bodies shaped to contain the disassembled aeroplanes as compactly as possible.

In the night fighting along the trenches searchlights have proved as useful as they are in the navy. It is necessary, naturally, to transport them from place to place on the lines with the greatest dispatch. An electrical generating plant to supply the electric current is an essential equipment.

The plan generally adopted has been to install the electrical plant in the truck so that it can be driven by the truck motor. The searchlight itself is mounted on a small hand car which can be trundled onto the truck platform over a runway. A long line of insulated wire connects the light with the truck power plant. On arriving at the place of action the small car is removed from the truck and pushed into place for use by the crew. The electric cable is attached to the searchlight



Paris Omnibus Chassis Converted to Sterilizing Equipment for the French Army.

and all is ready.

The large number of motor vehicles of one description or another now used by the armies, and the fre-

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quency of damage because of high speed over bad roads or the effects of shell fire, makes it necessary to have a large and efficient motor service corps. In the base towns factories are adapted for service stations, at which the overhauling and repairing is done.

For emergency repairs close to the fighting line trucks carrying very complete installations of machine tools and supplies of parts have been adopted. The tools are mounted inside the van bodies. The sides are usually arranged so that they can be let down, enlarging considerably the platform upon which the mechanics can work. The interiors of the bodies are equipped with shafting to operate the tools and power is supplied by the truck motors.

Tank wagons of the type used by American oil companies are a necessity for bringing up from the base supplies of gasoline and lubricating oil that are required for the many motor units.

A use of trucks which is new and more or less experimental, and which is probably not as important as many of the others—although it is more picturesque—is that of taking artillery observers to points of vantage behind the lines and carrying equipment by which they may be elevated to points where they can observe freely the effect of the shots upon the enemy.

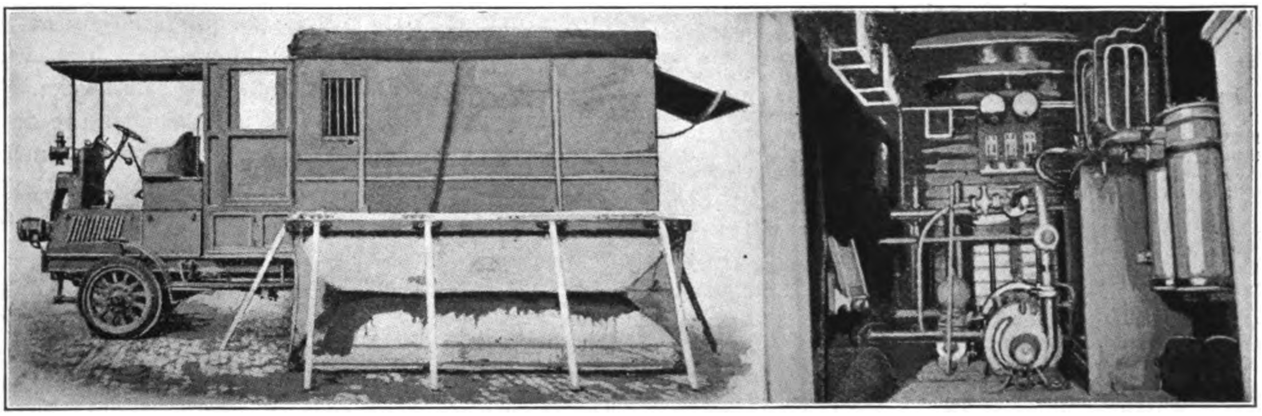
Some of these trucks are equipped with long ladders, others with man-lifting kites which carry up the observer and his field telephone, and some carry balloons for the same purpose. The chief special equipment with the balloon and kite types are motor reels for drawing the aircraft in quickly when the observers wish to descend.

While the United States army is at present very small, it will be readily recognized that if it undertook to equip itself thoroughly with all these various types of motors a very considerable expenditure would be involved and the successful builders would secure a worth while volume of business.

In the accompanying illustrations is shown a motor unit for sterilizing water for drinking and hospital purposes in the French army. The chassis is a 35 horsepower Schneider construction that was formerly used as a Paris omnibus. On each side of the body are wooden frames, which can be pulled down horizontally and which support collapsible canvas tanks. One of the tanks is filled with water to be sterilized by a small electrically driven pump.

The electrical equipment consists of a dynamo operated by the truck engine. Current is raised by a transformer to very high voltages, capable of producing emanations which by their action on the air create ozone. These emanations are produced between two non-conducting glass plates, the exteriors of which are charged at different voltages. As the temperature of the plates rises rapidly a cooling system consisting of metal water jackets is supplied for them. The water in the cooling system serves at the same time as conductor for the current.

After ozone has been created it is brought into contact with the water as it passes over two opposed cones. There is a little air space between the two cones and here the water absorbs the ozone, which sterilizes it very quickly. When the water reaches a basin at the bottom of the car the ozone bubbles out of it, leaving it pure and suitable for drinking purposes. The apparatus will treat five cubic meters of water per hour. It is used in places where the water is known to have been contaminated.



One of the Two Canvas Tanks Used for Purification of Contaminated Water, and an Interior View Showing the Electrical Equipment.

Another illustration shows one of the special trucks used by the British army to haul sea planes which are in use for scouting along the coasts. These trucks are so arranged that planes may be mounted upon them with a minimum of disassembling. The trucks make good speed.

One of the motor repair shops accompanying an Australian division of motor transport is shown in an accompanying picture. It is mounted on an English commercial chassis. Such a shop with all equipment is said to have cost about $25,000. They average about a ton lighter than the motor repair shops used by the English army.

Automobile trucks are to be used experimentally for the delivery of parcel post matter in Worcester, Mass., with a view of determining the advisability of a change from horse vehicles.

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RESULTS OF PACKARD SERVICE POLICY.

THE convention of service managers organized by the National Automobile Chamber of Commerce at Detroit, Mich., June 29-30, brought together the representatives of 57 different companies, seven of which manufacture motor trucks and wagons exclusively, 17 produce both trucks and pleasure cars, and 33 build pleasure cars exclusively. The subject of service was from every angle and was general rather than specific because of the prevailing belief that the same policy could not be well applied to both pleasure cars and service vehicles.

The papers read were from the viewpoints of the companies whose representatives presented them, and in connection with these unusual interest obtains in statements made by Alvan Macauley, vice president and general manager of the Packard Motor Car Company, whose company has a well defined policy, and whose experience has been such as to justify a positive expression of opinion. Mr. Macauley's paper was as follows:

Every motor car manufacturer, before marketing his first car, has to decide, and does decide, just what standard of excellence of product he will offer to the public. And he announces his policy through his advertising, etc., and, therefore, there is a very strong moral obligation upon him to deliver his vehicles —cars or trucks—fully up to his established standard of excellence.

If for any reason, one or more of his vehicles prove, in use, to be below that standard, then he should supply new parts and the labor necessary to bring that vehicle, or vehicles, up to his standard. This repair work should be and almost invariably is, done gratis, under the terms of the warranty adopted generally by members of the N. A. C. C. This kind of repair work we may call warranty work. I don't know how it is generally denominated among the rest of you. In any event, it is repair work which the manufacturer does gratis, willingly, because of the moral obligation that is upon him. To this extent, service policy for cars and commercial vehicles should be identical.

Beyond this point of moral obligation, I can find few reasons why service policies for the two types of vehicles should be identical, but I can find a number of reasons why they may well be different.

Of course, a great many manufacturers and dealers carry their gratis repair work far beyond the terms of the warranty. In fact, most of us do, even when the repair work has been necessary by ordinary use or abuse. Now, it is not within my subject to discuss the wisdom or unwisdom of charging for repairs beyond the line of moral obligation to which I have referred. I wish merely to establish the fact that it would be perfectly right to charge for such work if the manufacturer or dealer saw fit to do so. Therefore, such work, if done gratis, must be considered as good will advertising; and we can do as much of it to trucks, or as little of it to cars, as we think advisable. If we think it pays us to do more for our trucks than we are willing to do for our cars, there can be no claim against us of unfairness, in either direction.

But there are, it seems to me, even more obvious reasons why our service policies, as affecting cars on the one hand, or trucks on the other, can be different.

Speaking of our own business: The Packard company's policies are based upon the fact that each of our dealers is equipped with a shop at which he has all the facilities for repair work. If the owner will avail himself of the facilities of our dealers, in the way most economical to the dealers; that is, by bringing his vehicles to the dealer's repair shop, then the owner will get his repair work done at a minimum of expense. But if the owner insists upon having his repair work done in a manner that is not most economical to the dealer, then the owner has to pay for the luxury.

I won't attempt to differentiate between the terms of our car and truck service policies. They are considered in a paper I was asked to read recently. I will confine myself, instead, to saying that we made them different because, after trying faithfully to make them the same, we found conditions and requirements so different that we reluctantly gave up the effort, briefly, for the following reasons:

Truck drivers ordinarily do not have time, during business hours, to work on their trucks. They are engaged, from the opening hour of business to its close, in delivering merchandise. The chauffeur, or driver of a car, on the other hand, usually has several intervals during the day when his car is not in service, and is, therefore, available for adjustment or repairs. For this reason, we feel that we should do more for the truck and its driver, because he has less opportunity to do for himself.

Again, the truck is a relatively slow moving vehicle. It's no hardship, and it takes very little time, for a chauffeur or owner to drive his car five, 10, 15 or even more miles to the dealer's place of business. Whereas, to cover the same journey in a truck requires a much longer time—so long a time, usually, that the owner simply cannot afford to take his truck out of his delivery service, except, of course, in the relatively few cases in which the owner maintains a spare truck.

These reasons are the principal ones that led us to a separate service policy for trucks, though there are others of lesser importance. For instance, the fact that trucks are less under the personal observation of their owners than cars, which makes monthly inspection and monthly reports to owners very desirable. Also, trucks are usually operated by less competent and responsible drivers. They run on solid tires instead of pneumatics, and have to go where business is, regardless of the nature of the paving.

Both our service policies are based upon the theory that it is our function not to assume the responsibility for keeping vehicles in first class condition, but only to assist owners and drivers to that end. They must do their respective parts.

EUROPEAN ARMIES NEARLY EQUIPPED.

Reports from both England and France indicate that the motor transport divisions of the armies are now possessed of a nearly adequate supply of trucks and motor cars, and it is unlikely that there will be large renewals of orders for American trucks. With the armies at a standstill in the trenches the destruction of trucks has not been great in recent months and production of the European factories, with the large purchases of trucks in America, is nearly equal to the demand. In case the line breaks and there is fast movement either way, it is likely that many trucks will be destroyed, in which event more American orders may be placed. Russia is not so well supplied, however, and will probably continue buying heavily for some time. The French army is said to have all the tires it can use. The standing order to French factories to produce as many tires as can be turned out has been modified and now tires are produced only on definite orders as to quantity.

GOODYEAR PRODUCTION IS ENORMOUS.

A single day's production by the Goodyear Tire and Rubber Company recently reached 15,447 tires. The company had been the first to set records of 5000 and of 10,000 tires for a one day's output. The lower prices announced on motor cars for the coming year indicates an unprecedented demand for tires and P. W. Litchfield, factory manager of the company, expects that very shortly a production of 20,000 tires a day will be necessary to keep pace with the demand.

A co-operative delivery system for groceries, meat markets and other retail stores has recently been established in Champaign, Ill. It is said to reduce the cost of delivery 50 per cent. Forty delivery wagons are replaced by the trucks. Twenty of the former delivery men will enter the employ of the new company and the others will be given positions as clerks.

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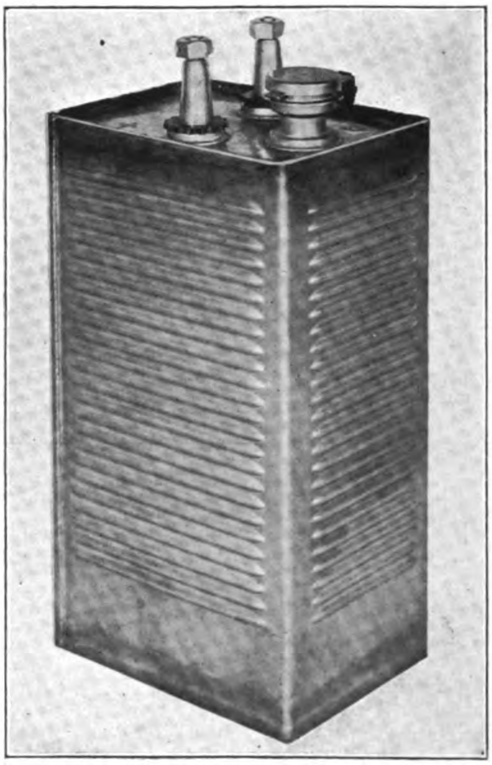
ELECTRIC VEHICLE PRACTISE.

Characteristics of Edison Nickel-Iron-Alkaline Cells, Which Differ Diametrically from Lead-Acid Types—Elemental Description of the Generation of Energy by Oxydization and the Probable Chemical Actions and Reactions.

(By William W. Scott.)

WHILE lead-acid cells are made the world over, and there is no restriction upon their manufacture, an entirely different condition obtains with reference to the Edison nickel-iron-alkaline cell, which is the invention of Thomas A. Edison, and is manufactured under his patents by the Edison Storage Battery Company. Lead-acid cells have been developed through the research and experiments of chemists and scientists of America and Europe since the discovery of the voltaic couple in 1790, the greatest progress being in the last half century, and with greatest refinement during the last generation. Junger in Europe has produced a nickel-iron cell, but it has never been manufactured commercially and it is not to be considered as serviceable for motor vehicle propulsion.

Because patents protected the Edison cell, so-called, its development has been confined to the company owning the patents, and its exploitation has not been stimulated by research or experimentation of others. The electric world has been educated to the qualities and characteristics of the Edison cell, but general knowledge of its chemistry and construction has been retained by the manufacturer and has not been available for scientists who might care to engage in endeavor to further develop it.



An Edison A8 Cell Completely Assembled.

The principles of the Edison cell are practically diametrically opposed to those that characterize the lead-acid cell. The electrolyte is an alkali and not an acid, the influence of the electrolyte upon the electrodes is preservative rather than deteriorating, the electrolyte only is slowly deteriorated by use, the cell and its element are not affected by shocks or jolts, it may be left charged or discharged for considerable periods of time without permanently affecting its efficiency, it may be charged at extremely high rates without damage to the electrodes, it may be discharged at high rates without impairing it, it will maintain its amperage during discharge with a gradual decrease of voltage, while the lead-acid cell will maintain its voltage with decrease of amperage. The capacity of the lead-acid cell is maximum shortly after its formation, from which it will gradually diminish, the ratio of diminution of capacity being governed by several factors, while the nickel-iron-alkaline cell will gradually increase to considerably in excess of the rated capacity and will maintain this for a very long period. The nickel-iron-alkaline cell also has a reserve that can be obtained by overcharging to a definite maximum. The comparison of efficiency of the nickel-iron-alkaline and the lead-acid cells cannot be made unless an average is taken covering a specific period. A laboratory test of two new cells will show an efficiency ratio of from 60 to 65 of the input of energy against a ratio of from 75 to 82 for the lead-acid cell, but the nickel-iron-alkaline cell will maintain this ratio for a long time, from four to five years, while the lead-acid cell will diminish to such a point that it is no longer serviceable in periods ranging from 10 months to 2½ years, so that average efficiency and not initial efficiency must be taken. These statements are general and not specific, for some lead-acid cell manufacturers claim extremely long life for their batteries, and obviously design, construction, material and operation are all governing factors with reference to service.

The life of the Edison cell is uncertain in that no service has as yet developed any precise period that can be regarded as a standard. The manufacturer guarantees that the cells, if normally used, will maintain their rated capacity for four years, and instances are frequent of the cells being in use five years or longer and still exceeding the rating. Longevity is one of the strong claims that is made for the nickel-iron-alkaline cell.

From the foregoing facts one will note that there are

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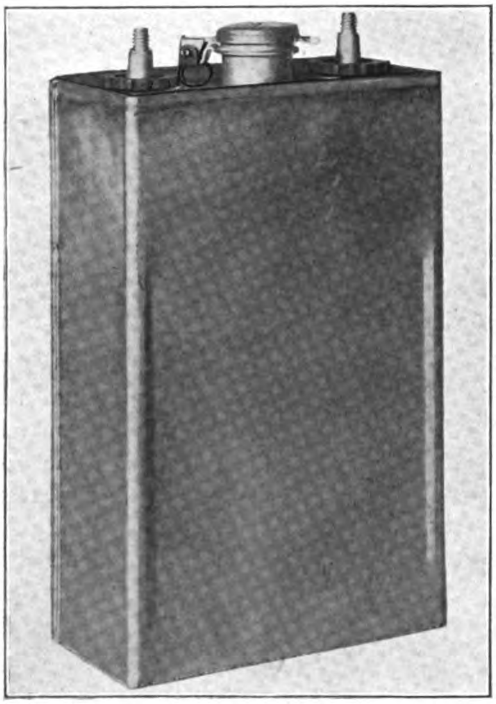

A Fully Assembled Edison B4 Cell.

specific qualities that differentiate the nickel-iron-alkaline from the lead-acid cells, and there are uses for which each is especially adapted, while they may both be used for many purposes. The Edison cell has less voltage range than the lead-acid cell, the maximum voltage when fully charged being 1.85 volts, and the minimum voltage for permissible discharge is 1.2. For this reason a greater number of cells is necessary to obtain a definite standard voltage.

The line voltage necessary for charging cells in series is determined by multiplying the number of cells by 1.85, and to obtain the same voltage as with a 44-cell lead-acid battery normally charged, 60 Edison cells would be necessary, the one requiring 110 volts to charge to 2.5 volts a cell, and the other 111 volts to charge to 1.85 a cell. The Edison cell battery will require more space to carry, but the weight will be from 35 to 48 per cent. less than the lead-acid battery, despite the increased number of cells. This may be said to range from 300 to 900 pounds less for batteries of the same mileage ratings for vehicles ranging from 1000 to 10,000 pounds capacities.

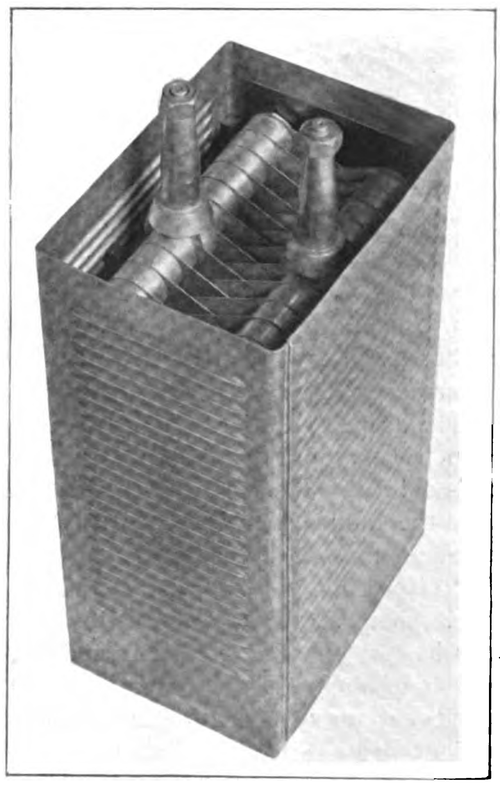
The basic principle of the Edison cell is the "oxygen lift," or the transfer of oxygen from the one electrode to the other. Oxygen combines with a vast number of substances in differing forms, and will combine freely with metallic iron, this combination causing what is known as "rust" or oxide of iron. The formation of this oxide or rust develops energy in the form of heat or electricity. In the Edison cell the current is not stored or accumulated, but it transforms the oxide of iron into pure metallic iron by the removal of the oxygen combined with it to the nickel hydroxide element, and when a circuit is made the pure metallic iron is combined with oxygen, rapidly oxidizing it and creating heat and energy. Thus the cell is in itself a generator of electric energy. This is an extremely elemental manner of describing the operation of the cell.

The combinations of iron and nickel oxides and water, which is the basis of the electrolyte, are not destructive, and they are not deteriorated by the movement of the oxygen from the one to the other, and for this reason the Edison cell differs with all other cells that have been referred to in previous chapters.

The nickel-iron-alkaline cell is primarily a container in which are placed two series of plates, the positive plates being composed of nickel hydrate and the negative plates of iron oxide, while the electrolyte is a solution of distilled water and caustic potash or potassium hydrate, which is the ordinary potash purified so far as is practicable. The iron oxide is practically a powder, it being very finely divided, so that it will contact with the greatest volume of the electrolyte. The characteristic of the iron to combine with oxygen is understood.

The positive plates are composed of nickel hydrate or oxide of nickel, and one of the characteristics of this metal when combined with a certain volume of oxygen is to receive more oxygen, this combination transforming it to a super-oxide or higher oxide of nickel. The water and the two oxides are the agencies which do the work. When the cell is charged the electric current passes through the iron oxide to the nickel oxide, and while charging the oxygen is taken from the iron oxide and reduces it to pure metallic iron—in other words, removing the oxygen. The nickel oxide has become a super-oxide of nickel because of the transfer of the oxygen by the electric current, it having absorbed all of the oxygen that was combined with the iron.

When the current is drawn from the cell and the movement is in reverse from that when the cell was charging, the iron will receive the oxygen from the super-oxide of nickel. The iron cannot receive this oxygen and become rapidly oxidized without creating and delivering energy, and as the charge is discharged the oxidization continues, in greater or less degree as the cell is drawn on. As energy is required to reduce the oxidization of the iron energy is developed, as the iron is again oxidized.


Edison Cell with Top Can Removed to Show the Element.

Regarding the nickel-iron-alkaline cell from the fundamentals of chemistry, the statement should

be made that the principle is the oxidization and reduction of metals in an electrolyte that does not dissolve, and will not combine with, either the metals or their oxides, and the use of an electrolyte which, notwithstanding its decomposition by the action of the cell, is immediately reformed in equal quantity, and is, therefore, a practically constant element without change of density or conductivity during long periods of time. Because of this principle but a small volume of electrolyte is necessary and the proximity of the plates is very close. As the electrolyte is not diminished, taking of hydrometer readings is unnecessary until about 300 cycles of charge and discharge have been completed, and the purpose of such reading is to determine when complete renewal of the solution is necessary. As the active materials of the electrodes are insoluble in the electrolyte, no chemical deterioration can take place.

The electrolyte is a solution of distilled water containing 21 per cent. of potassium hydrate and a small volume of lithium hydrate. When the cell is made the active materials of the electrodes are not put in as metals, but as nickel hydrate and iron oxide respectively, although the active metals of the electrodes, which are oxidized and reduced in the solution, are nickel and iron.

When the cell is active there are no complicated chemical changes. The positive active material, nickel hydrate, becomes an oxide when the first charge is given the cell, in which the nickel has a higher valency, and it is never thereafter reduced to its original state by future cycles. With every cycle of the cell the negative plate changes to metallic iron on charge, and goes back to its original form, iron oxide, with discharge.

When the first charge is given the cell the nickel hydrate is converted into a high oxide, probably NiO_2, and the iron oxide or hydroxide is reduced to metallic iron. On discharge, the nickel oxide, NiO_2, of the positive plate is reduced to Ni_3O_4, and the metallic iron of the negative electrode is converted to Fe_3O_4. Upon recharging the products NiO_2 and Fe are again formed.

The electrolyte, potassium hydroxide, enters into the reaction, but in the end it is regenerated and is undiminished in quantity. It is probably separated into the ions K and OH, which produce chemical change, after which the potassium hydroxide is again formed.

The chemical reactions for the above have been written as follows:

$$nKOH = nK + nOH \text{ (ions)}.$$

In the first charge—

$$Fe_2O_3 + 6K + 3H_2O = 2Fe + 6KOH \text{ (negative)};$$
$$3Ni\,(OH)_2 + 6\,(OH) = 3NiO_2 + 6H_2O \text{ (positive)}.$$

In discharge—

$$3Fe + 8(OH) = Fe_3O_4 + 4H_2O \text{ (negative)};$$
$$6NiO_2 + 8K + 4H_2O — 2Ni_3O_4 + 8KOH \text{ (positive)}.$$

In recharging—

$$Fe_3O_4 + 8K + 4H_2O — 3Fe + 8KOH \text{ (negative)};$$
$$2Ni_3O_4 + 8\,(OH) = 6NiO_2 + 4H_2O \text{ (positive)}.$$

Perhaps a simpler manner of representing the changes stated above would be to consider that the current, on charge, in passing from the positive to the negative electrode, decomposes the KOH into the ions K and OH, K passing with the current and carrying a charge. On reaching the negative electrode the charge is given up to it, after which the atom of K unites with the water to form KOH and H is liberated thus:

$$2H_2O + 2K = 2KOH + H_2.$$

The H liberated then acts on the negative plate to reduce it to metallic iron, thus:

$$Fe_2O_3 + 6H = 2Fe + 3H_2O \text{ (negative)}.$$

The ion OH formed on charge passes to the positive plate and on reaching it gives up its charge to it, after which it unites with water to form H_2O and O is liberated, thus:

$$H_2O + 2HO = 2H_2O + O.$$

The O liberated then acts on the positive plate, thus:

$$Ni(OH)_2 + O = NiO_2 + H_2O \text{ (positive)}.$$

On discharge, K goes to the positive plate, liberating H, which acts on it thus:

$$2NiO_2 + 8H = 2Ni_3O_4 + 4H_2O \text{ (positive)}.$$

HO goes to the negative plate and O is liberated, which acts on it thus:

$$3Fe + 4O = Fe_3O_4 \text{ (negative)}.$$

On subsequent charge the H liberated at the negative plate acts on it thus:

$$Fe_3O_4 + 8H = 3Fe + 4H_2O \text{ (negative)}.$$

And the O liberated at the positive plate acts on it thus:

$$2Ni_3O_4 + 4O = 6NiO_2 \text{ (positive)}.$$

Probably other reactions take place, as mercury is used in the composition of the positive plate for the purpose of better contact, either to promote chemical action or to reduce internal resistance.

Those who understand chemistry can follow these equations and from them gain practical information relative to the activities of the cell during charging and discharging, but the same statement made with reference to lead-acid cells obtains with the Edison cell—that these are general results rather than all of the actions and reactions that take place.

One fact, however, is obvious, and that is the transfer of oxygen from the positive to the negative electrode and from the negative back to the positive, and that this cannot have destructive influence upon the element of the cell. The electrolyte consists of the solution of distilled water and 21 per cent. of caustic potash, and theoretically there ought to be no diminution of the capacity of the cell, for there is no loss of the active material, and the only condition that might affect it is the loss of volume of electrolyte. This, of course, can be compensated by the introduction of a new solution into the cell.

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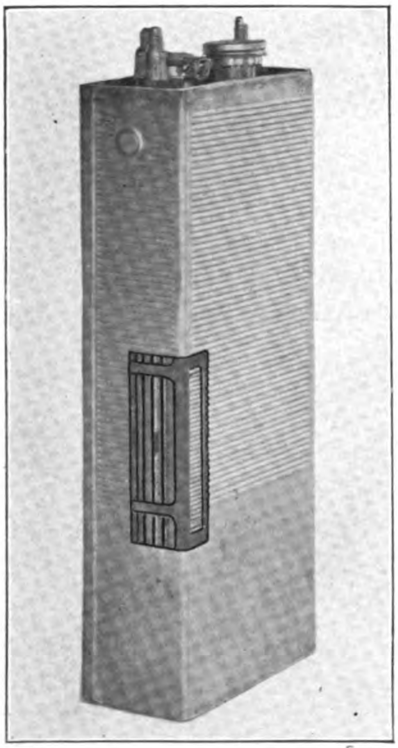
There is the possibility of the plates becoming "dirty" through the accumulation of foreign matter in the cell if care is not taken to use distilled water, and the vessels in which the water is kept and handled are not kept perfectly clean. Distilled water can be obtained in practically every community of considerable size, and the cost is comparatively small. The water is to be regarded as pure when sold by the distributor, but evidently it can be contaminated if care is not taken to keep the containers closed and to clean the vessels used for filling, as well as cleaning the cells.

In practise there is, however, loss of capacity, probably from the accumulation of foreign matter on the plates, but this is extremely small and with normal use the reduction is hardly appreciable. Edison cells have been used for years, and no service has been of sufficient length to justify the manufacturer making a definite statement relative to the probable life of a battery, other than the guarantee of maintenance of the rated capacity for four years unless damaged by misuse or neglect.


Edison Cell with Section of Can Cut to Show Assembly of Element.

The nickel-iron-alkali cell has been developed through laboratory experimentation and from service. The laboratory work is constant, but this is conducted by those who understand the construction of the cells, their peculiarities and can deal with them from the attitude of specialists or experts. The service experience must be extended over long periods of time, and it will develop conditions that would not be met with by the laboratory workers because they would by their operation and methods avoid or avert them. Because of the control of the manufacture by the Edison Storage Battery Company there has been no incentive for others than the company's experts to engage in research and development work. The present type of cell was approved by Mr. Edison as meeting his standard early in 1909, and since then the guarantee has been made that a cell will maintain its rated capacity at the expiration of four years, when used with approved apparatus, irrespective of number of charges and discharges, or the total mileage if used in vehicle propulsion, there being no service limitations.

In this and the subsequent articles that will deal with the Edison cell no service other than in vehicles will be considered.

(To Be Continued.)

REO ENLARGES TRUCK PLANT.

Extensions to the plant of Reo Motor Truck Company are to be larger than were at first planned. Work has already been started on a tract of 4½ acres which is to be devoted to truck business. Fifteen two-ton trucks are now being shipped every day by the company.

The expansion will include an addition to the general assembling department of a three-story structure 101 by 256 feet, the final assembly department will be increased by a building three stories high and 115 by 138 feet, and the present assembling building will be increased by two additional stories, 80 by 153 feet. A three-story addition, 50 by 74 feet, will be added to the engineering building. Shipping facilities are to be greatly increased through the construction of a loading dock along the Grand Trunk railroad, 347 feet long and 36 feet wide.

MORE RECORD TRUCK EXPORTS.

Previous records for motor truck exports were again broken for May, and the passenger car exports, which have been running below normal since the beginning of the war, greatly exceeded those for the same month a year ago. The report shows that 2426 trucks, valued at $6,583,912, and 4921 passenger cars, valued at $3,971,483, were sent out of the country.

In May, 1914, only 99 trucks, with a value of $127,-024, and 3157 passenger cars, valued at $2,857,601, were exported. This year's May record exceeded that of April when motor vehicle exports for the first time passed the $8,000,000 mark. During the 11 months ending in May exports valued at $46,889,835 were divided between 11,006 trucks, worth $30,561,880, and 19,462 passenger cars priced at $16,327,955.

DECISION ON SOLID TIRE PATENTS.

The scope of the patent of Edwin B. Caldwell covering solid tires used on some commercial vehicles, has been limited by a decision in a suit brought by the Swinehart Tire Company of Akron, O., and the patent holder, against the Motz and Goodyear tire companies. The court held that the Motz tire did not infringe the Caldwell patents and affirmed, with costs, a previous decision of the United States district court. Caldwell's patent covered a solid tire of two lobes with a V shaped depression between them, to allow for lateral expansion of the rubber. Motz's patent describes a "circumferential valley" for the same purpose and the court held that these were different things.

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TEAM OWNERS' ASSOCIATION STUDY MOTOR TRUCKS.

THE keen interest of the National Team Owners' Association in motor transportation was shown at its annual convention in Springfield, Mass., June 29, when two papers on the subject were read. One on "The Development of the Gasoline Tractor," was by C. H. Martin, the inventor of the Martin tractor and an authority on the subject, and the other by Merrill C. Horine of the Commercial Vehicle, who spoke on "The Motor Truck and Why," analyzing the reasons which are bringing about a constant increase in motor transportation and which forecast a sharp decrease in the use of horses.

Tractor is defined in the dictionaries as meaning "that which draws," said Mr. Martin, and under that definition the ordinary horse wagon is a trailer with an animal tractor. Originally he said the horse had carried his load on his back, and later it had been found possible to carry a greater load by placing it as the Indians did on two long poles, so that part of it was carried and part of it drawn by the horse.

The invention of the wheel made it possible for the animal to haul much more than he had ever carried on his back. Then for thousands of years, until the invention of the locomotive, practically all hauling was done by animal tractors and wheeled trailers.

The wagon of today, Mr. Martin said, is one of the most highly developed, practical and reliable pieces of mechanism that man has, for it is the result of several thousand years' experience. Every useless part has been eliminated. It stands up and does its work year after year with a minimum of expense. Considering the thousands of years that it has taken to develop the wagon and the very few years that have passed since the first truck was designed, truck progress has been wonderful.

After the truck had been in practical use for a short time it was brought forcibly to the minds of engineers that its necessarily high first cost and high operating expense, and limited range of action, left very little margin for profit when it was brought into competition with the horse. It would show a profit if the hauls were long, the roads were good and there were facilities for fast loading and unloading; under other conditions the horse was found to be cheaper.

Although the truck had been brought to a high state of development, it was still in the class of the weight carrying or pack animals. The next step was to make it do more work and that was accomplished by following the earlier precedent and making it haul the weight instead of carrying it.

The tractor principle is coming in for special attention today in all of the alert factories. In most trucks there is sufficient power to draw over a good road a considerably greater weight than the springs, frames and other parts of the truck will support. The transmissions, propeller shafts and other parts that take the driving strain are designed to withstand the power of the motor. If a truck designed to carry five tons is loaded to its full capacity and driven against a brick wall and the power then turned on, the driving wheels will turn, slipping over a dry street. This shows that the motor will pull just as much as the traction between the driving wheels and the road will admit of.

The Semi-Trailer Equipment, Which Will Carry Double the Capacity of a Truck, Demonstrated at the National Team Owners' Association Convention.

There are two means of making a motor truck into a tractor. One is the four-wheeled trailer principle and the other the two-wheel or semi-trailer principle. Here the problem of traction enters.

Where the designer must depend on friction as he does in the city streets, where no kleets or spikes are allowed, he must use a material with a high coefficient of friction. Much experimenting has been done with wood blocks and with combinations of wood and steel, but rubber has been established as the standard. The cushioning effect of solid rubber tires is of little value, as that can be taken care of by springs, as it always was in the steel tired wagon.

The railroad locomotive obtains sufficient traction on steel tires to pull 40 or 50 times its weight on the level, but there are no railroad grades of more than two per cent., except on some of the mountain roads, where three per cent. is the limit.

As we ascend a grade the percentage of weight re-

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quired to secure traction ascends by leaps and bounds and as roads are not limited to two or three per cent. grades, as the railroads are, the motor truck, used as a tractor, must have a percentage of weight on the driving wheels in proportion to the grade over which it operates.

The majority of merchandise is loaded and unloaded at chutes and platforms where it is necessary to back the vehicle in to get it into position. Were it not for these two problems—that of traction and of the necessity to back in—any motor truck could be utilized as a tractor by simply having a four-wheeled trailer hitched on behind. This is done with some success in many places, but to obtain the highest degree of efficiency tractor and trailer must be so designed as to be handled by one man, have traction to go any place and constructed so it may be backed into position. There are some four-wheeled trailers made that with the help of an extra man can be backed into any position. But no part of the load can be used for traction. Vehicles of this type are used over level roads in many sections of the country.

But the highest degree of efficiency is reached under the semi-trailer plan, where part of the load is carried on the driving wheels and part drawn behind on trailer wheels. There is always sufficient weight for traction. The trailer can be backed into any position, without the aid of an extra man. The trailer can be jacked and left to be unloaded at convenience, while the tractor goes after another load.

The truck is limited to hauling the kind of merchandise for which its body is designed. But the semi-trailer installation can haul as many kinds of loads as there are different wagons to attach, low bed wagons, end dump wagons, bottom dump wagons, long and short wagons or passenger busses. Half the weight is carried on steel tires with a great saving of rubber. There is no waiting on loads by the truck or driver.

While any truck can be used as a trailer in this manner, far better results are obtained on the whole if the tractor is built especially for the work with short wheelbase, short turning radius, extra low gear and other desirable features known to every designer.

S. A. E. BALLOTS SENT OUT.

Ballots for the vote on the new standards proposed by the S. A. E. have been printed and distributed among the members. The vote will be complete by Aug. 16. Reports of the seven divisions that are to be voted on are those covering carburetor fittings, electrical equipment, electric vehicles, iron and steel, miscellaneous, spring and bell housings. The Motor Truck has published a resume of the proposed changes.

Few motor trucks are purchased in Japan according to a letter from the B. F. Goodrich representative in Tokio. The letter gives a list of Japanese business men who have agencies for American trucks.

FORTY TRUCKS FOR DETROIT MAILS.

Forty motor vehicles in Detroit are to be put in service Aug. 15 carrying mail, and if the result is as successful as is expected large additional purchases will be made for other cities of the country.

For Detroit 40 machines are to be bought at once in accordance with contracts made when a number of trucks was recently purchased for the Washington postoffice. That means that 24 Ford chassis equipped to carry half-ton loads. One three-ton, seven 1½-ton and four three-quarter-ton Whites will complete the fleet.

A general advertisement for bids for five or more machines of the same type is to be put out. These bids will probably determine the purchases of the government for motorizing the entire mail service.

W. H. Haylock, superintendent of mails in the Washington postoffice, in a talk to the Electric Vehicle Association recently declared that if a light electric, that could be operated by an ordinary carrier, could be developed for use in making collections from mail boxes and for parcel post deliveries where the distances between stops are very short, the government would be able to purchase a large number of them for postal service.

CALIFORNIA MOUNTAIN 'BUS LINE.

Hauling passengers, mails and freight between Ducor, Cal., and California Hot Springs, a 'bus line has been operating for four years. It makes connections with Southern Pacific trains and 'bus tickets are sold by the railroad.

There are now three 'buses in operation, as the business has grown to be too large to be handled by the original 'bus. The line has boomed the whole mountain district in which it operates. Grades are as steep as 15 or 20 per cent. Before the 'buses were in use four days was the average time required to get freight from San Francisco, but now it is delivered the day after its shipment. The passenger ride has been reduced from an all-day grind to a trip of about two hours.

Roy R. Bush, who joined the Velie Motor Vehicle Company as sales manager in August, 1914, and was later made general manager, and W. H. Morgan, who was local territorial sales manager for the same company, have resigned to engage in business as the Bush-Morgan Motor Company at 1526 Grand avenue, Kansas City, Mo. Mr. Morgan has been succeeded by H. B. Daniels, but Mr. Bush's successor has not as yet been announced.

The Consolidated Gas Company of New York City operates 27 trucks in its fitting department. They are electric machines and displaced 52 horse drawn wagons and 25 drivers.

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CERTAIN RECORD MEANS TRUCK TIME ECONOMY.

Practical Mechanical System That May Be Adapted to the Regulation of Haulage Work and Will Equally Well Control All Other Departments.

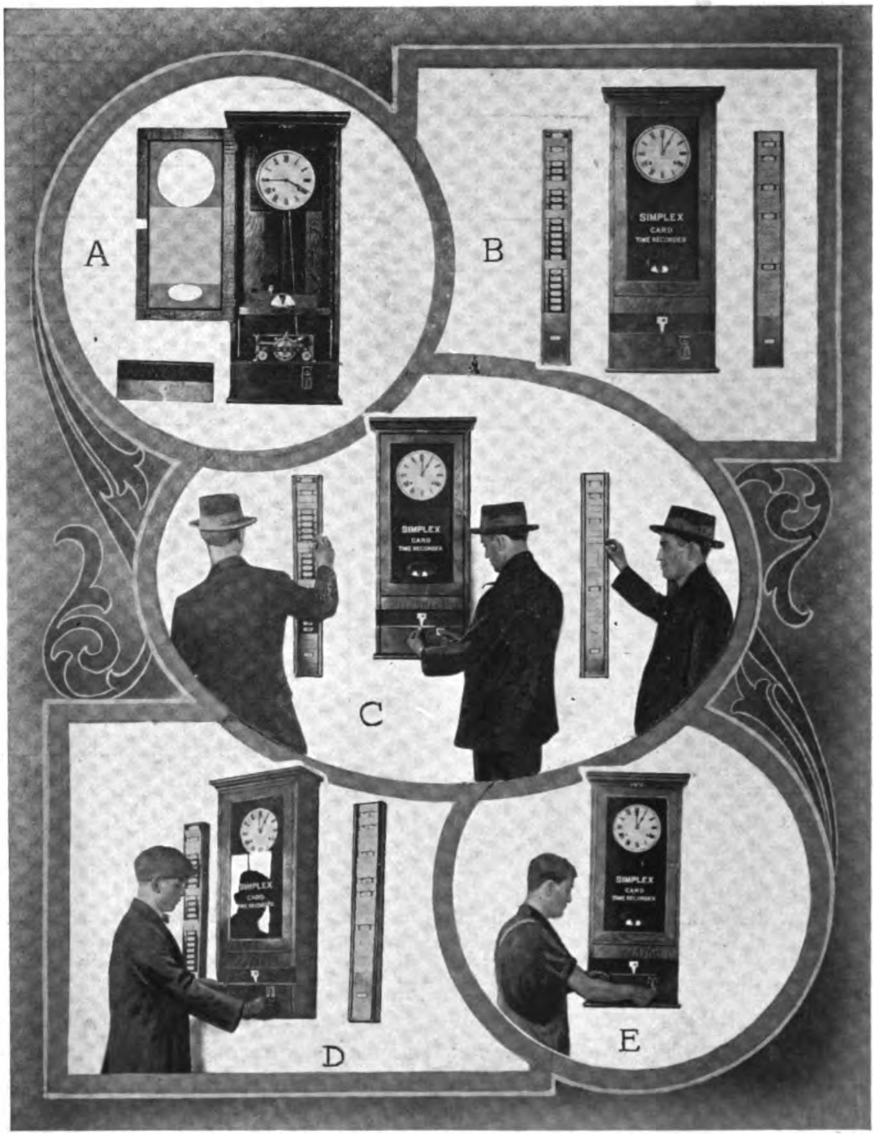
TIME is the most vital factor in motor vehicle service. Every truck owner who has made even an elementary efficiency study of his transportation equipment and its uses understands fully that the economy of his trucks, their earning value to him and the reduction of costs below those for other methods of haulage depend directly on ratio of running to stopped or idle time.

To increase the earnings of any truck only one thing is needed: It must be kept running under a paying load for a larger part of every day. For this reason a good system of keeping accurate account of time in connection with the use of the trucks is of the greatest importance to every owner.

He should have an accurate record mechanically made in such a way that it cannot be altered by the driver or any one connected with the truck, and made in such a way that human error will not enter. This record should show the time of the departure of the truck on every trip and the time of its return.

If the truck is operated between two fixed points, which are the same for every trip, as for instance if it runs between two plants of the same company, this record should be made at both ends of the haul. This will enable the owner by a study of the trip cards to determine just the amount of time the truck is in motion under load and will show at once if there is too much stopped time at any point in the hauling cycle.

It will enable him to detect at once any falling off in the efficiency of his truck, and will afford a basis upon which he can work out improvements in method that will increase the earning power of the machine. It will also enable him to locate the "leaks" in time which are the cause of direct loss to every truck owner.



Simplex Time Recording Clock and Method of Operation—(A) Clock Mechanism, (B) Components of System, (C) Workmen Registering Arrival at Work, (D) Chauffeur Recording Time He Takes Out Car, (E) Repair Man Registering Exact Time of Beginning of Job.

Several systems with various mechanical units and printed forms are employed for this purpose, but one that offers special advantages because of the wide range of uses which can be made of it is that of the Simplex Time Recorder Company, Gardner, Mass. This consists of an ornamental 15-day, 80-beat clock, with time stamping mechanism, a complete equipment of time recording cards and two ornamental oak card cases. The movement of the clock is the product of the Seth Thomas Clock Company of Torrington, Conn., which is assurance of its accuracy and high quality.

In addition to its usefulness as a time recorder, the clock is very desirable as a timepiece in a garage or a shipping room, where such an accessory is constantly

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useful. Its dial and hands are sufficiently large to be seen clearly for some distance. The time recording mechanism is concealed and protected so that unauthorized persons may not adjust it or alter records without being detected. There are three automatic type wheels, one with the number of days of the month, one with the hours from 1 to 12, and one with the minutes from 0 to 59. The hours from midnight to noon are printed in small sized type and underlined, while those from noon to midnight are printed in larger type and are not underlined. They may always be distinguished at a glance.

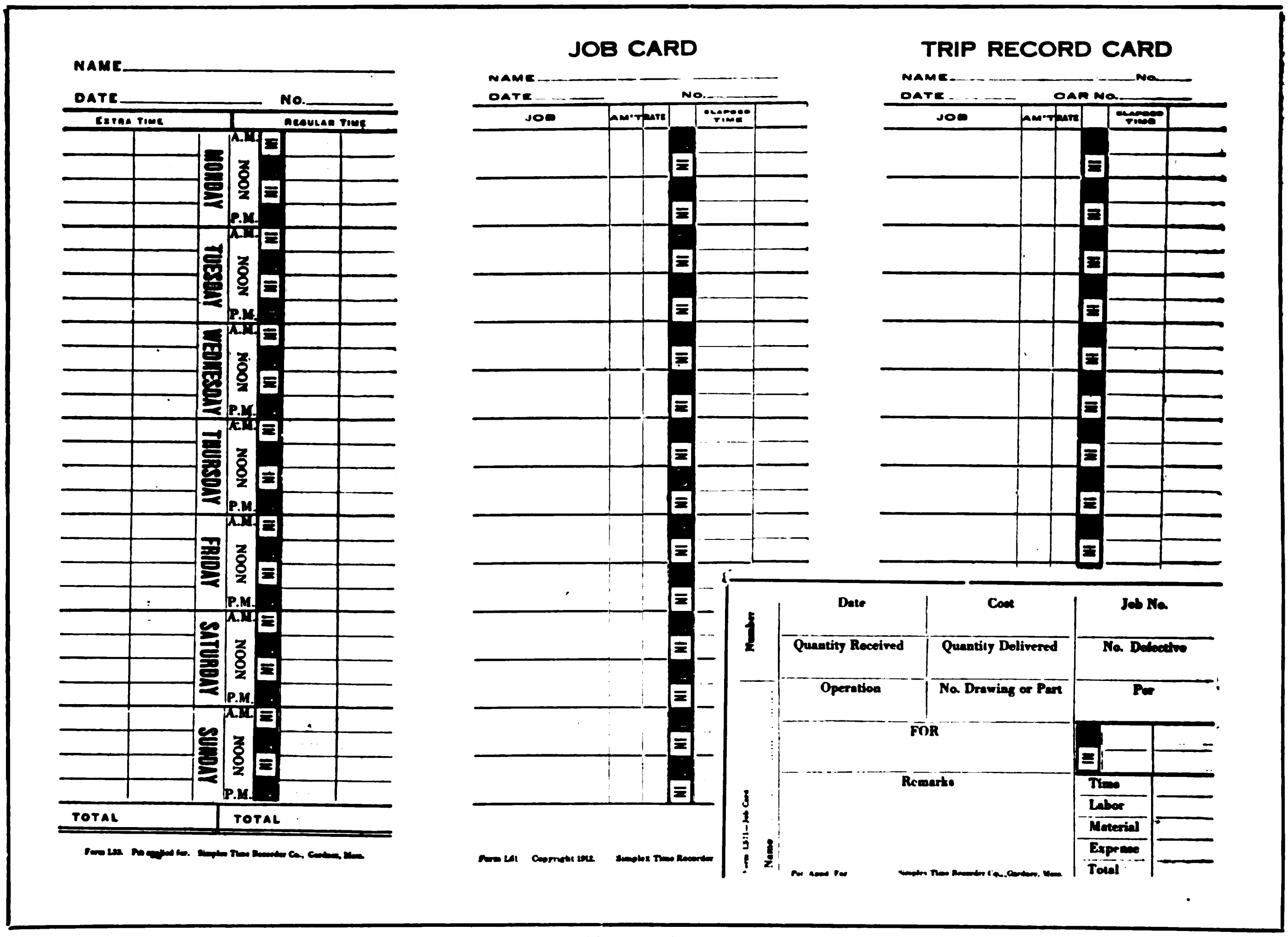
In a garage, at a shipping room, at a quarry or a sand pit, or in a coal, or building supply yard, this clock cannot only be used to keep track of truck time, but can be used as a regulation time clock to take the time of all employees of whatever nature who work there.

To fill these various needs three standard card systems are supplied by the clock makers and every business man will be able with a little study to work out special forms which cover the peculiar requirements of his own business, should he find that the standard forms are not applicable.

To truck operators the trip record card shown in the accompanying group will be of most interest. This will be seen to contain spaces for the name of the truck driver, his number, the date and the number of the truck. Below are spaces in which the job may be described. Behind the spaces marked "In" and "Out," the driver is required to punch the time on the Simplex Time Recorder the instant he arrives at headquarters on returning from a trip, or at the time he drives out on leaving. This record will show just what the truck has been doing every hour of the day.

In case the truck is operated between two establishments operated by the same concern, the same system can be installed at either end, making an "air tight" record of the truck's service. This would be practical in the case of a truck operating between two factories, one of which is used to produce partly finished product, and the other to turn out the completed product. An instance of this would be a truck used to haul lamp bulbs from a glass factory to an incandescent lamp works. It might be used in the same way between a quarry and a stone cutting mill, between a sand pit and construction work, between the contractor's material yard and a building operation, between brick kilns and the retail brick yard, and so on.

Or it may be that the truck owner operates a general transport business doing trucking for various par-



Four Standard Time Recording Cards Supplied with the Simplex Time Recording Clock—Workmen's Weekly Time Card, Job Card and Trip Record Form. Insert Shows Standard Form of Requisition Card, Which Can Be Changed to Meet Different Conditions as They Exist in Garages, Repair Shops and Service Stations.

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ties and bases his charges on time of service. In this case the spaces marked "Amount" and "Rate" upon the card will come into use, one to indicate the rate per hour and the other the amount to be charged. Or it may be that in connection with his cost system the truck operator who hauls his own material may wish to add transportation costs to his unit cost record. In that case a rate per hour for truck service can be worked on the average performance of his equipment and the rate and amount columns used precisely as though he were doing the work for some one else.

Used as a General Time Keeper.

If the truck owner operates a garage where a number of men are employed, he will wish to have a time clock installed there, not only to keep track of the work his men are doing, but to aid him in establishing his maintenance costs. In hundreds of businesses, such as coal yards, lumber yards, brick yards and building supply depots, keeping track of the truck work can be made only an incidental use for the clock, while its chief value is derived from the accuracy with which it accounts for the time of employees in all departments of the business.

For this purpose the weekly time card shown in the accompanying group is one of the forms used. This shows the time of the arrival of the men at their work and the time at which they quit at noon and at night.

An excellent idea of the clock installation and the manner in which it is used can be had from the group of photographs which accompanies this article. In illustration C of this photographic group the man at the right, having just quit his work, is selecting his card from the "in" case. The centre man is inserting his card in the slot in the recorder and recording the exact time by pressing down the registering lever. The third is depositing his card, which has been stamped in the "out" case. It is obvious that where this system is used a glance at the racks will show which workmen are in the shop at any time and which are not. It does away with much of the timekeeper's work, since the payroll clerk can take his data direct from the stamped cards at the end of the week.

It is impossible to dispute a mechanical record of this sort and arguments that mistakes have been made in the time record by employees who claim to have worked more time than they have been credited with, will not happen. Foremen are relieved of the detail of keeping track of the men's time and can devote their attention to getting out their work.

Keeping Job Cost Records.

The job card is another important item in the standard system. This is great value in the truck operator's garage or service station if he maintains one of considerable size. It is essential in all businesses where specific jobs are charged to different customers, or in a manufacturing or contracting business where careful account of costs is kept.

By its use an indisputable record is afforded of the disposition of every hour of labor for which the employer pays. Each card furnishes an accurate record of the exact time spent on each job. This can be seen at a glance and no computation is required. Space is provided so that labor costs on each item can be quickly computed. As on the weekly time card the employee's name and number and the date are placed at the head of the form. A card is supplied to each man for every day in the week. On beginning work on any operation he stamps the time on the card and on completing the work he stamps it again. This gives an excellent basis to judge the speed at which he works and makes it possible to judge also of the competence of the foreman in getting work done quickly, and in seeing that the men are constantly employed.

In businesses where the different jobs consist of working a certain amount of material in a specified way the requisition form shown in the group has great value. It provides spaces to show how much material was delivered to the man, the number he worked and delivered, the number he found defective, the nature of the operation that was performed, the description of the part, and the use to which the material is finally to be put. The time spaces provide a record of the number of hours necessary to complete the job. In this way the entire cost of the operation can be arrived at in a very short time.

TOOL AND STOCK REQUISITION

Stamp Time Here.

Job No..............

Workman's Name...........................No......

Stamp Time Here.

Stock Supplied..........................

....

....

Stamp Time Here.

Tools Loaned..........................

....

....

Stamp Tire Here.

Stock Returned........................

....

Stamp Time Here.

Tools Returned........................

....

Foreman's Signature.................................

Suggested Form for Tool and Stock Requisition for Use in Garages, Etc., in Connection with Simplex Time Recording Clock.

For those truck owners who operate garages of considerable size the tool and stock requisition shown herewith will be of interest. It is filled out either by the foreman or by a clerk and shows the material and tools supplied for each job. As will be noted from the illustration it has provision for all necessary information regarding the job. It has spaces for stamping the time at which the requisition was taken to the stock room and the time at which the tools and surplus material were returned. By comparison with the job card this is useful in enforcing promptness in

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cleaning up after a job and supplies a method by which time devoted to that purpose may be separated from that put in at the strictly productive work. An accurate record can be made from this form of the material used in truck repair. This is insurance against waste and is an important factor in a carefully kept cost system.

The adoption of a mechanical time accounting system of this sort has many beneficial effects on a business. The record is accurate and cannot be altered. It tells when men arrive for work, when they leave, what they do all day. It is as though the eye of the firm was constantly upon them. It eliminates opportunities for wasted time, cuts down the percentage of "late to works" and greatly increases the efficiency of the human forces of any business institution.

DEMONSTRATES MOTOR PLOW.

A large gathering of Scottish farmers on South Melville farm, near Edinburgh, witnessed a demonstration of the Fowler motor plow, which was conducted by R. D. Ewart, a motor engineer of Edinburgh. The plow is built on the lines of the ordinary horse plow and will do the work of three or four horses in normal work. As it does not require the rest that must be given horses it may do even more.

The depth of the work depends on the nature and condition of the soil, but during the demonstration a depth of nine inches was easily secured. It plows to the full depth to the end of the furrow. The plow is then lifted by a hand lever and the machine swung around by hand. It travels at a speed of two miles per hour. The cost of plowing by this method would be less than 85 cents an acre, in contrast with horse work, based on the high cost of horse feed and labor, which is $9.73 per acre. The cost of the plow is $786.90.

OIL ENGINES FOR CHINA.

Internal combustion engines using crude oil are reported by the United States consular service to be in considerable demand about Canton, China. The types generally desired are marine engines and those adapted for running small industrial plants, electric light stations and irrigating pumps. They should be very simple and operate efficiently when dirty or neglected. Chinese manufacturers are beginning to produce them, usually exact copies of foreign engines, but American and European producers can get business at their present prices.

So satisfactory has the new M & S differential, manufactured by the Brown-Lipe Gear Company for the M & S Gear Company of Detroit, Mich., proved to be on trucks sold to the allied armies that requirements for a differential lock which were made on all orders for trucks have been withdrawn where this differential is used.

TEST OF NATALITE FUEL IN ENGLAND.

A new motor fuel, known as Natalite, and made of alcohol distillates at sugar refineries in Durban, Natal, was recently tested by the Royal Automobile Club of England. It showed many characteristics which promise to make it much more important than many of the substitutes for gasoline that have recently been tried.

It was found that it could be used in an ordinary gasoline motor with the usual carburetor, the only adjustment necessary being a slight reduction in the volume of air admitted. In a test of 500 miles it was entirely successful in running the car under all conditions, producing as much power as gasoline.

The mileage yielded per gallon was slightly less than that for gasoline of .71 specific gravity, but this is of little significance if it should prove that under conditions of large scale production, with a removal of excise restrictions on alcohol, it could be produced more cheaply than gasoline.

Its present cost produced under prevailing conditions is 12 cents a gallon. In tropical countries it can be distilled from crops that can be grown in any desired quantities. In many of those countries gasoline is now so costly as almost to exclude the use of motor hauling in considerable volume.

The perfection of this fuel would be a tremendous influence in developing those markets for the motor car and truck manufacturers. By reducing the volume of gasoline consumed it would probably decrease its price even in the localities where it is now cheapest and would set a limit over which the price would not go for fear of competition.

The fuel is said to be absolutely free from the tendency to carbonize the cylinders, which is common with gasoline, and it is even said that it will remove carbon from cylinders in which it is used for a little time.

Illinois motorists will now have to pay the wheel tax under the new law passed by the legislature. The first enactment was declared unconstitutional and the payment of the tax was not required during May and June. Only 84 per cent. of the tax need be paid for 1915. For vehicles under 35 horsepower the tax will be $8.34 instead of $10. Higher powered cars must pay a proportionately higher rate.

In order to produce 125 trucks a month for delivery to European armies, the Four-Wheel Drive Auto Company of Clintonville, Wis., has broken ground for a new factory building. Its present output is 75 trucks a month.

Vincent Link, for several years truck engineer for the Packard Motor Car Company, has taken charge of the engineering department of the Standard Motor Truck Company, Detroit, Mich.

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HUDFORD INTERNAL GEAR DRIVEN CONVERSION UNIT.

CONVERSION of the pleasure car chassis for service purposes is not generally a success from either a practical or economic viewpoint, from the fact that the rear springs and rear axle and wheels are not designed to carry heavy loads, even if the frame has sufficient strength, and while the power plant may be in every way adequate and enduring, the construction of the chassis is not what could be expected to withstand the work that a service vehicle must do to be profitable.

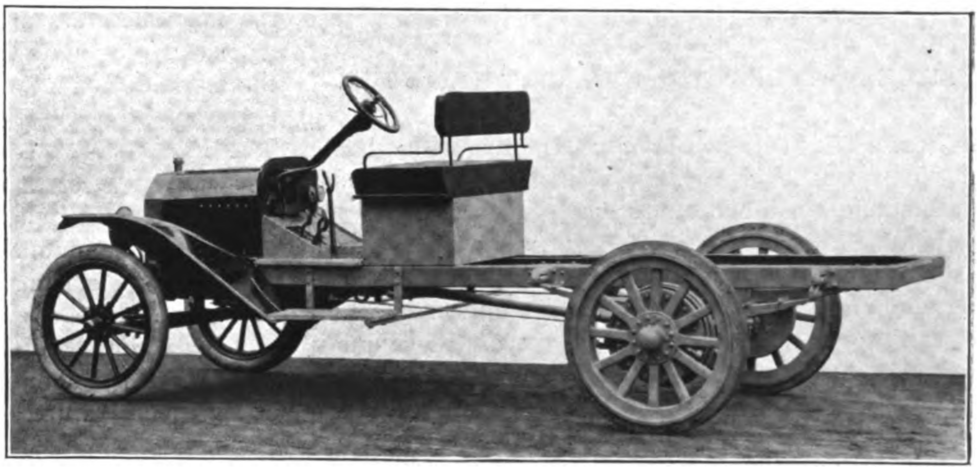
The comparatively small cost of the Ford chassis and its economic qualities generally have impelled many people to convert them into service wagons, which is usually done by installing a body that will have sufficient space to carry a freight of considerable bulk. With such equipment, however, the almost universal result is overloading and quick deterioration must follow, because the speed is not reduced.

With any Ford chassis the safe load is not much in excess of 600 pounds, and with such a freight the highest speed ought not to be more than 20 miles an hour, but the engine is not governed and without material reduction of the rear axle differential gearing, which cannot be accomplished save by considerable expense and practically reconstructing the axle, the drivers will drive faster than good judgment should dictate.

The Hudford Company, Philadelphia, Penn., is manufacturing a unit with which a Ford chassis may be converted so that it will carry 2000 pounds of freight, and the speed is so much reduced that a safe limit cannot be exceeded. This unit consists of a frame, springs, internal gear drive rear axle and wheels and a main driving shaft, which may be used in combination with the power plant, frame, front spring and axle and wheels. The machine when assembled has regular Ford wheels with pneumatic tire equipment forward, and substantial truck wheels with solid tires for the rear wheels. The unit is so proportioned that no greater load is carried on the front axle than when a Ford chassis is used for passenger service, and for this reason no change is made in the original construction. As the greater part of the freight is borne by the rear axle, this is not only changed to a dead type that will endure greater stresses than will probably ever be placed on it, but the design is such that with this strength it is extremely light.

The frame of a Ford chassis is 100 inches length, and the main frame of the Hudford unit is 156 inches. The Ford wheelbase is 100 inches and when the Ford and the Hudford units are assembled the wheelbase is 120 inches, with a considerable over hand that will substantially support any body that is placed upon it, and when the load is 2000 pounds approximately 90 per cent. will be carried by the rear axle. This frame is installed surrounding the Ford frame, the two being secured by strong cross members, the Ford frame becoming practically a sub-frame, in which is suspended the power plant.

The rear springs are semi-elliptic and the frame is suspended between them, the springs being pivoted at the front ends and shackled at the rear ends. The traction and torque stresses are through the front ends of the springs, there being no radius rods. The internal gear driven rear axle consists of a solid load-carrying member on which is mounted a jackshaft that has the usual bevel gear and differential gearset assembly, the



Ford Chassis, Converted with a Hudford Unit Into an Internal Gear Driven Truck Having a Load Capacity of 2000 Pounds.

ends of the jackshaft carrying spur pinions that mesh with internal ring gears that are mounted inside the drums attached to the rear wheels.

The jackshaft is enclosed by a housing, the outboard ends of which are supported by the spiders that cover the internal gearing and which carry the anchor studs and the camshafts of the internal expanding brakes. The differential reduction is very small, but the reduction of the internal gearing may be either 7:1 or + 6:1, the former ratio being standard and the latter optional if the owner desires a faster vehicle. The wheels are equipped regularly with solid band tires, but pneumatic shoes are generally installed when the higher speed ratio is specified. The rear wheel brake is ample for all purposes, the drums being large and wide faced, and are connected through the usual linkage with the hand lever. The brake is ample to lock the wheels with practically any load placed on the machine.

The driving shaft of the Ford chassis is replaced by a larger tubular shaft with a slip joint at the rear end.

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so that there is no end thrust upon the shaft, and the size of the shaft prevents whipping. The original control of the power plant is retained and this affords a maximum speed of from 15 to 18 miles an hour when direct driven, and the large reduction in the low ratio of the planetary gearset is such that the truck will have ample power for any work for which it could be used with a maximum load.

The disassembling of the Ford chassis for assembly with the Hudford unit requires but a few hours. The Ford rear tire equipment is 30 by 3½-inch pneumatic tires, and the rear wheels with the larger tires are installed on the forward axle so as to have the benefit of the largest shoes. The unit is constructed to patents and it is sold for $325. With this unit the owner of the Ford chassis can convert it to truck use, and dealers can make conversion of new chassis and sell them for comparatively small prices, there being trade discounts from the list price of the unit. When chassis are converted the complete Ford rear axle, rear spring, driving shaft, front wheels and tires are available for repairs or replacements in standard Ford chassis. The body equipment is whatever the owner may desire.

MILES ENTERTAINS N. A. C. C. MEMBERS.

Samuel A. Miles has been entertaining at his home at Christmas Cove, Me., 30 members of the National Automobile Chamber of Commerce, who came together for a business session and outing. There was a programme of two days' fishing, swimming and boating, and one day of business. At the business session it was shown that carload shipments of the chamber members were more than 100 per cent. greater in June than for the same months last year. The figures are 15,308 carloads, against 7492 carloads last year. There was an encouraging report regarding the willingness of the various makers to adopt a uniform time of announcing new models. A more liberal attitude on the part of legislative bodies to fairly hear those interested in jitney 'bus legislation was reported.

"CATERPILLAR" IS HOLT TRADEMARK.

Recent announcement of a new tractor on self-laying tracks as the first "caterpillar" tractor to be built in America calls forth the statement of the Holt Manufacturing Company of Stockton, Cal., that it has made caterpillar tractors for 10 years, that there are now 15 firms making them in the United States, and that the word "Caterpillar" has been registered as a trademark in the United States by the Holt company, and in many foreign countries as well.

The common pleas court in Columbus, O., has held that the law licensing chauffeurs is invalid because it sets no standard of qualifications, leaving that entirely to the secretary of state. The case will probably be appealed to the supreme court.

WHY AMERICAN PLUGS ARE BEST.

Discussion has been going on in the Autocar, the leading English motor trade journal, regarding the reasons why American plugs are so much more efficient in American engines than the English plugs, which, of course, the English believe to be vastly superior.

Fred J. Gordon, a prominent member of the trade in London, gives this explanation:

"The reason is that the American plug manufacturers specialize, whereas the English manufacturers generalize. If anyone will peruse the catalogue of the Champion Spark Plug Company, Toledo, O., U. S. A., who make about 75 per cent. of the plugs used in the United States, he will find that this company makes a special plug for practically every well known type of car.

"Before a plug is put out the Champion company obtain from the manufacturer a typical engine and the plug is tested on this engine under every condition—over lubrication, over heating, etc.—and only when the manufacturers are absolutely satisfied that this particular plug suits this particular engine is it put on the market.

"That is why the Ford company has adopted this plug four years in succession and it is the only plug that has been found to give absolute satisfaction on this car. The Champion company even goes the length of doing its assembling in an electrical furnace, which is heated to the same temperature as the engine cylinder. The plugs assembled under these conditions, which are similar to those encountered in actual work, are, therefore, immune from the effects of expansion at high temperatures, and consequently do not leak or crack.

"The English manufacturers, on the other hand, sell their plugs on the principle of the patent medicine vendor, assuming that every type of plug will suit every kind of engine, with results that are somewhat expensive to the motorist. My advice to the owner of an American car is to stick to the American plug until the English manufacturers have gone more deeply into the matter of adopting special plugs to special requirements."

KELLY HEADS ELECTRIC MAKERS.

George H. Kelly, secretary of the Baker R & L Company, has been elected president of the Electric Automobile Manufacturers' Association at its annual meeting in Cleveland, O., succeeding L. E. Burr of the Woods Motor Vehicle Company. Mr. Kelly is thoroughly familiar with all the details, needs, purposes and aims of the electric vehicle industry.

Motor service on two rural mail delivery routes out of Topeka, Kan., has been established.

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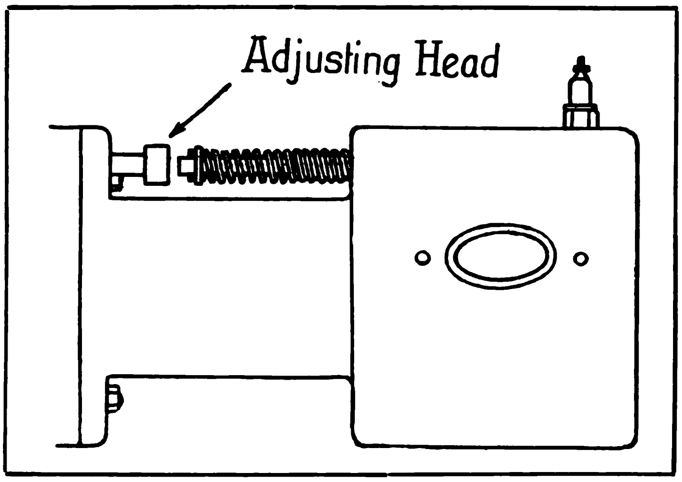
MECHANICAL QUERIES ANSWERED.

Adjusting Valves—C. L. G., Willow, Cal.

In one of your back issues I read how to adjust valves and push rods, but I find that my one-cylinder Reo truck has no adjusting nut on the plunger. When the valve is closed there is about ⅛-inch play, but I do not know how to take it up. I am told that the company has discontinued to make these trucks and there is no repairman in this vicinity that knows a great deal about them. Will you advise me how to reduce the play between the plunger and the valve stem and where I can obtain further information in the future?

The Reo one-cylinder truck is manufactured by the Reo Motor Car Company, Lansing, Mich. Although the company has discontinued to manufacture them,



The Shimmed Nipple for Making the Adjustment of the Push Rod of the Reo One-Cylinder Truck Motor.

any information will gladly be furnished. It is true that this type of car is not fitted with any adjusting nut, but close inspection will show that there is or should be a nipple over the end of the push rod at the point of engagement with the valve stem. Inside this nipple are several fine round shims, and as you state the play is ⅛ of an inch, you should remove the nipple and insert a number of shims until only a space about the thickness of an ordinary name card remains. Of course this nipple can only be removed and replaced when the valve stem is forced back and this can best be done with a thin screw driver. The push rods in the crank case are held by adjustable brackets, and when timing is difficult adjustment is made at the nipple. I would, therefore, suggest that the timing disagrees with the markings on the flywheel before inserting any shims.

Benzol Fuel and Carburetor Floats.

The following letter, which is self-explanatory, was originally sent to General Manager Coker F. Clarkson of the Society of Automobile Engineers, and copies have been distributed to class publications for the general information of the industry. The letter is worthy the careful consideration of every manufacturer of float feed carburetors, and is from Charles W. Eves, director, of Munster, Simms & Co., Belfast, Ireland:

Owing to the conditions now ruling in the United Kingdom, we anticipate that large numbers of American automobile trucks will find their way into this market.

We do not know whether your manufacturers are aware that a very large and rapidly increasing percentage of the vehicles of this type now running in this country are being operated on purified benzol, owing to the much higher efficiency (about 25/30 per cent.) which can be obtained from it than from petrol (gasoline).

We are aware that many makers of American standard carburetors use cork floats, which are generally coated with shellac varnish. This varnish is petrol proof, but quickly soluable in benzol.

If we may be permitted to make a suggestion, we believe it would be in the interests of both manufacturers and users to have metal floats supplied with carburetors on trucks exported to the United Kingdom. We write with a first hand knowledge of the question, as we are large distributors of benzol ourselves.

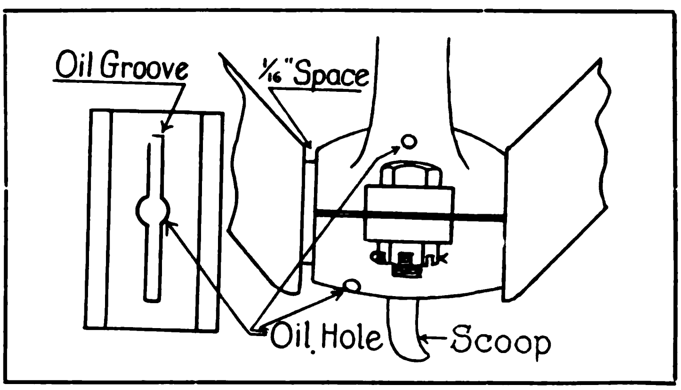
If you think our suggestion worth passing on to the manufacturers who are likely to be interested, we shall not have written in vain.

The statement that is the basis of the letter ought to be of special significance to manufacturers of carburetors in view of the fact that a considerable number of American industrial interests are now preparing to produce benzol in commercial quantities, and there is anticipation of finding a ready market for this product. The majority of makers of carburetors of the float feed type using cork floats would, no doubt, be able to adapt them for the use of metal floats. The metal float, of course, can be used with any fuel, but even with gasoline or kerosene shellac varnish will deteriorate and the cork become saturated so as to be unserviceable until dried and again varnished. Should benzol be utilized to any extent as fuel metal floats must be fitted to all carburetors in which it is used.

Engine Overheats—C. N. T., Boston, Mass.

During the past two months I have fitted two connecting rods to the front piston on my three-ton truck and now it is necessary to fit a third rod. I have increased the oil level, but it does not seem to help, and causes the car to smoke. The cooling system is in perfect order, but yet the motor quickly overheats. I am a machinist by trade and believe myself capable of fitting a connecting rod to a crankshaft, but the cause of this trouble is beyond my ability to solve. The oiling system is splash and the water circulation forced by a pump. A suggestion may be of much benefit to me.

Overheating may be the result of several conditions, such as an impeded circulation, loose fan belt, bent fan blades, carbon in the cylinders, poor carburetion, lathe timing, sticking valves, etc. One cannot state positively from the information given just what may cause the front connecting rod bearing to fail.



The Grooves and Oil Holes for Truck Engine Connecting Rod Bearings to Insure Efficient Lubrication.

You do not state whether it burns or breaks. If it breaks the cause is either poor material or it is out of alignment. As you no doubt know babbitt metal

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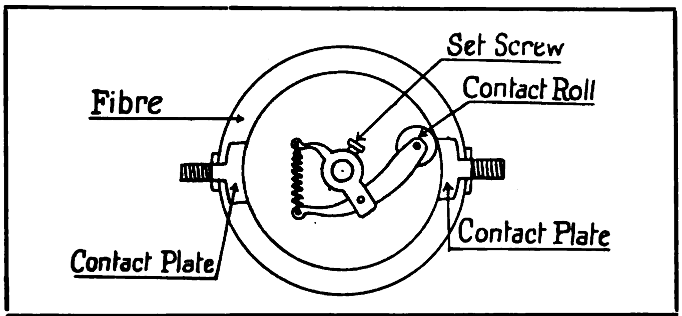
should be heated for pouring to the point where it will ignite a piece of paper. If the bearing burns it must be due to insufficient oiling. To secure adequate lubrication it is imperative that a space of about 1/16 inch should be allowed for side play between the rod bearing and the ends of the crank pin. This play is also necessary for alignment purposes, especially if the truck has been considerably used. Two small holes should be drilled through the bearing, one in the upper half and the other through the lower part. An oil groove should then be cut horizontally to about ¼ inch from the ends, taking care of course that the groove registers with the oil hole. The writer is of the opinion that either you have forgotten to fit the oil scoops to the bottom of the rod, or they are not long enough to dip into the oil reservoir. This condition quickly causes overheating and if not promptly corrected may cause damage to the motor.

Timed Wrong—R. McG., Jackson, Miss.

I drive a one-ton, two-cylinder Rapid truck, which has a dry cell ignition system. I have always been successful in doing my own repairs, but I now have a trouble I cannot locate. The motor has no power and starting is extremely difficult. The battery is new, the wires in good order and the terminals fast. The carburetor is clean and there is no dirt in the pipe. The adjustment has not been touched, as it has always afforded efficient operation. The compression is good on every cylinder. The plugs seem to fire strongly when grounded on the cylinder, but yet the power is missing.

The loss of power and difficult starting is probably due to late firing. When the motor is timed late the



Means for Adjusting the Timer of a Two-Cylinder Motor to Correct Late Firing.

spark, although strong, occurs in the cylinder after the piston has started on its downward stroke. This condition decreases the compression pressure and causes a slow burning mixture, which not only causes rapid formation of carbon, but also causes "popping back" in the carburetor. This is the result of the mixture not being fully consumed before the intake valve opens. If the writer remembers correctly, the contact arm is attached to the camshaft by a small set screw, as shown in the accompanying illustration. Late timing can, therefore, be the result of one of two things, the roll or arm has moved from its position on the camshaft or the commutator shell or case retards too much. It is my opinion, however, that the former is the cause. I would advise you to remove one of the spark plugs and ground it on the cylinder. Now place a piece of wire through the plug hole until it touches the piston. Determine the compression stroke and when the piston reaches dead centre, which can be ascertained by the wire, the relation of the contact point and the roll should be noted. With the spark lever retarded this is the point that the spark should take place and if it is not made the set screw in the roll should be loosened and the latter moved on the shaft until it just touches the contact point in the shell. Do not forget to securely tighten the screw.

Drive Chain Snap—New Owner, Charlotte, Mich.

I recently sold my horses and bought a five-ton —— truck. I do not know a great deal about trucks, although I have owned a pleasure car for a number of years. The person who sold me the machine said that should the drive chains become loose to lengthen the radius rods. This I did, but ever since then a loud snapping sound is made when the truck is in motion. Can you explain the reason for this?

Providing that the chains are in good order, you have unquestionably lengthened one rod more than the other. Of course, if there is one or more broken rolls, it is possible for a sprocket tooth to force the broken link out of engagement with a very loud snapping sound. I would, however, suggest that you test the rear wheels for alignment. Select a flat place on the front axle and run a line to a point close to the wheel on the rear axle. Mark the line at the point that it touches the rear axle and then repeat the operation on the opposite side of the car. Adjustment can be made at the radius rods so that both sides of the rear axle are the same distance from the front axle. If it is now found that one chain is too slack, I would advise taking out of a link. I may suggest that the cause of most chain trouble is the result of improper care. Experience has shown that satisfactory service is generally obtained if the chains are removed from the car at the week end and allowed to remain over Sunday in kerosene. This will remove the grit from the roll bearings, and then they should be lubricated with thick oil or oil and graphite.

Manufacturers' Service—J. M., New Haven, Conn.

One of the most important things you want to impress on the manufacturer of the trucks and motor vehicles is service. My experience as a dealer in trucks and pleasure cars is the poor service we get from the manufacturer. They advertise and also impress on our minds what great service we can give the public. It takes from 10 days to six weeks to get the parts from the factories.

Now, imagine yourself through my advice as having disposed of your horses and vehicles; that you have to depend on your truck every day, and your truck is held up for 10 days to six weeks for some petty stock boy, waiting for his convenience to send you parts; and more than half the time sending them wrong.

This is not my experience with small and cheap concerns, but more with large concerns. Now, in order to be the goat for the concern he represents, the dealer has to keep from two to three trucks on hand at his expense to give the customers the service the factory guarantees, which practically eats all the profit.

The manufacturers have got to wake up to this problem, or they will have to send their own men out to sell trucks and reorganize their companies every two or three years. I dispose of 200 trucks and pleasure cars each year and know what I am talking about.

Ignition Trouble—Ford, New Haven, Conn.

What causes my Ford motor to miss on one cylinder at low speeds? It runs all right when speeded up. The mixture is all right.

The trouble is doubtless due to a spark plug, and the fact that the cylinder fires at high speeds indicates that the gap of the plug is too large. Remove the plugs and set the gap to the same space as the others. When the gap is too large the spark is weak, as the voltage is not sufficient to bridge the space.

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STANDARD SERVICE POLICY FOR DEALERS.

SERVICE managers and some officials of the companies which are members of the National Automobile Chamber of Commerce, meeting at the Statler hotel in Detroit, Mich., June 29 and 30, under the chairmanship of Alfred Reeves, general manager of the N. A. C. C., took important steps toward establishing a service policy which can be adopted by all motor vehicle manufacturers.

The chief result of the meeting was to appoint a committee to formulate a standard plan on the basis of the views expressed at the meeting. This will be approved or changed at a later meeting of the service managers and will then be submitted to the N. A. C. C. for adoption.

It was also voted to recommend to the chamber that it inaugurate a common advertising campaign to educate the owners as to what should be expected in the way of free service, and also to take up the matter of putting the convention's views relative to service before the various local trade organizations. It was the opinion of the majority that general repair shops should be refused trade discounts on parts in order to protect the dealer.

The need of different service policies for passenger cars and trucks was generally accepted. It was also the opinion that censoring from the factory the orders of the various dealers was good policy, as the experience of many dealers does not fit them to judge intelligently of the number of parts of various types that their business is likely to require. Delivery of parts C. O. D. was discussed from many angles, but the general opinion was that it provided the best method of dealing with the matter.

Definite Code of Service.

Everybody agreed that an accepted code printed and supplied to dealers so that all might know just what should be given free to the owner in the way of service was very necessary. It is the most effective plan yet suggested to end the cut-throat competition between dealers, which eats up the profits they should make. The subject was brought up by General Manager Reeves, who urged the adoption of such a code.

Alvan Macauley, vice president and general manager of the Packard Motor Car Company, said he thought the question of service policy was the most vital in the automobile business at this time. Whether manufacturers get this service down to a reasonable basis and hold it there will be a large factor in determining whether or not they stay in business. Dealers, he said, had to contend with all sorts of customers, women, men trading on their names and influence, and all trying to get as much as they can for nothing. Things given gratis dissipate the dealers' profit and they must have relief.

Educational Campaign Advocated.

A. B. Cumner of the Auto Car Company thought the makers should co-operate in a general advertising campaign to educate people as to what they should and should not expect in the way of service. The hint that a new car may soon be purchased, is used by many owners to hold dealers up for a character of service that they cannot afford to give in the opinion of E. W. Cotton of the McFarlan Motor Company.

In establishing the service system of the Maxwell Motor Company four chief points were kept in view by Charles Gould, service manager, who described the work at the convention. The first essential is to have a sufficient supply of parts at some point where they can be reached quickly by the customer. Difficulties arising from accidents and improper use of the machines should be covered by straight repairs and not by free service.

The owner ought to know exactly how much free service he is to get and before any repairing is done he should be told how much it will cost if it is possible to tell him. In case of disagreement between the owner and the dealer the manufacturer should act as a judge, he believed.

W. H. Doddridge, head of the Winton service department, thought any standardized plan would have to be flexible, as owners differ in temperament. He thought that most dealers paid too much attention to the words "booster" and "big man," which were used freely by persons who were trying to get something for nothing. Salesmen imply that wonders will be done in the way of service by such phrases as "leave it to me" when any question comes up.

No Travelling Service Men Suggested.

E. T. Klee, service manager of the Stutz Motor Car Company, thought it best not to have travelling service men, as they make trouble for the dealer and make it too easy for owners to get free service to which they are not entitled. He also described a system by which the Stutz company makes sure that when a dealer is credited with a part it is used in the owner's car. This is done by billing all parts to the dealer and allowing credit only when the name and address of the car owner has been received and he has been notified that the part was sent to the dealer without charge.

The sales department is responsible for most service troubles in the opinion of A. J. Banta of the Chicago Locomobile branch. Service means everything for nothing with many salesmen, he said. That salesmen should keep service as far in the background as possible is the view of G. E. Drawe, assistant secretary and treasurer of the Pathfinder company, who said that the car buyer is usually a better salesman than the car salesman, else he would not have the money to buy a car. Thus he is able to work the salesman for whatever he wants in the way of service and accommodation.

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Chalmers' View of Service.

A. B. Hanson, Chalmers service manager, said his company regarded service not as something for nothing, but as the promptest, most efficient attention at the least cost. H. W. Drew of the Nordyke & Marmon Company, thought that service should be general and educational. It should consist of sending good instruction books and form letters from time to time, giving directions as to the proper methods of caring for a car.

The meeting seemed to agree that the dealers' service policy should go further than the manufacturers' guarantee. Many of the service managers thought that many successful dealers had studied their locality and clientele and were already successfully handling the service situation, and that it was a ticklish matter for manufacturers to attempt to instruct them. A standard plan, they thought, would be chiefly valuable for small and weak dealers.

Percy Owen, general sales manager of the Chalmers Motor Car Company, said he believed in definitely stating what the dealer may be expected to do in the way of service. For that purpose his company divides service given to owners into several different headings, technical service, shop service and repair work. Technical service means thorough inspection and adjustment of cars and each dealer is expected to give this free for some time after a car is sold. Shop service consists of free labor in installing parts which are furnished free by the manufacturer.

Before a standardized service policy can be adopted and the consumer educated to it, the plan will have to be drawn up and acted upon by the heads of the various companies through the National Automobile Chamber of Commerce, Mr. Reeves explained.

Where Policies Should Differ.

Mr. Macauley of the Packard company read a paper in which he said that truck and passenger car policies could be the same up to a certain point, from which the demands diverged so that a separate policy for each became necessary. He said that while the particular policy adopted was not so important, the chief object was to place something definite in the hands of the dealer and get him to live up to it. Then the owner would know exactly what to expect.

Representatives of White, Reo and other companies said that their policies for trucks and passenger cars differed, generally in being more liberal with the trucks.

It is good policy in the opinion of C. W. Matheson, director of service for Dodge Brothers, to have the parts orders of dealers carefully checked over so that they can be prevented as far as possible from carrying large stocks of parts for which they have no use.

When a change of models is planned dealers should be advised, so that they will not put in orders for parts that will soon be superceded. By taking into account the average selling rate of cars in any territory, it is easy, he said, to figure out approximately the number of parts of any particular type that are likely to be needed there. Dealers should be given a time limit of one year, after which the manufacturer should be allowed to exercise his option regarding the redemption of obsolete parts.

There was a general sentiment favorable to penalizing the dealer for returning old model parts after a certain time. It was recognized that the demand for various parts might vary according to the topographical characteristics of the country in which the cars are used. It was considered a good plan to use a maximum and minimum stock standard whereby a dealer would be obliged to order a certain number of parts when his stock of a given part falls below the minimum number named as his standard. This would effectually protect the owners and insure prompt filling of orders for replacements.

EXPOSITION AWARDS HONORS.

The Grand Prize in the motor vehicle industry at the San Francisco International Exposition has been awarded to the Packard Motor Car Company for excellence of automobile construction considering time in business, output and other factors. Recipients of gold medals were the Pierce-Arrow Motor Car Company, Cadillac Motor Car Company, Ford Motor Company, and the English Rolls-Royce, Ltd., the Federal Motor Truck Company and Hendee Manufacturing Company, maker of Indian motorcycles. The Kissel Motor Car Company of Hartford, Wis., received a silver medal and the Bricose Motor Company a bronze one.

FORD BUYS IRON ORE LAND.

Henry Ford has purchased a tract of 1000 acres of iron ore land near Oakwood, Mich., on which he purposes to develop mines and establish furnaces for reduction and mills for manufacturing steel, which will be used for the building of farm tractors. The plan comprehends the employment of a large number of men, one estimate being 20,000. The development is not to be undertaken immediately.

CLUB AND SECTION MERGED.

The Electric Motor Car Club of Boston has been merged by vote of the members with the New England section of the Electric Vehicle Association of America, this action resulting from the fact that the interests of the two organizations were identical and the work in which both were engaged could be the better served by consolidation and concentration.

The Avon Tire Company, Lynn, Mass., maker of solid tires, has increased its working force to 200 men. The firm has occupied the buildings formerly used by the Sagamore Rubber Company at East Saugus, Mass.

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THE HOWARD 1500-POUND SHAFT DRIVEN TRUCKS.

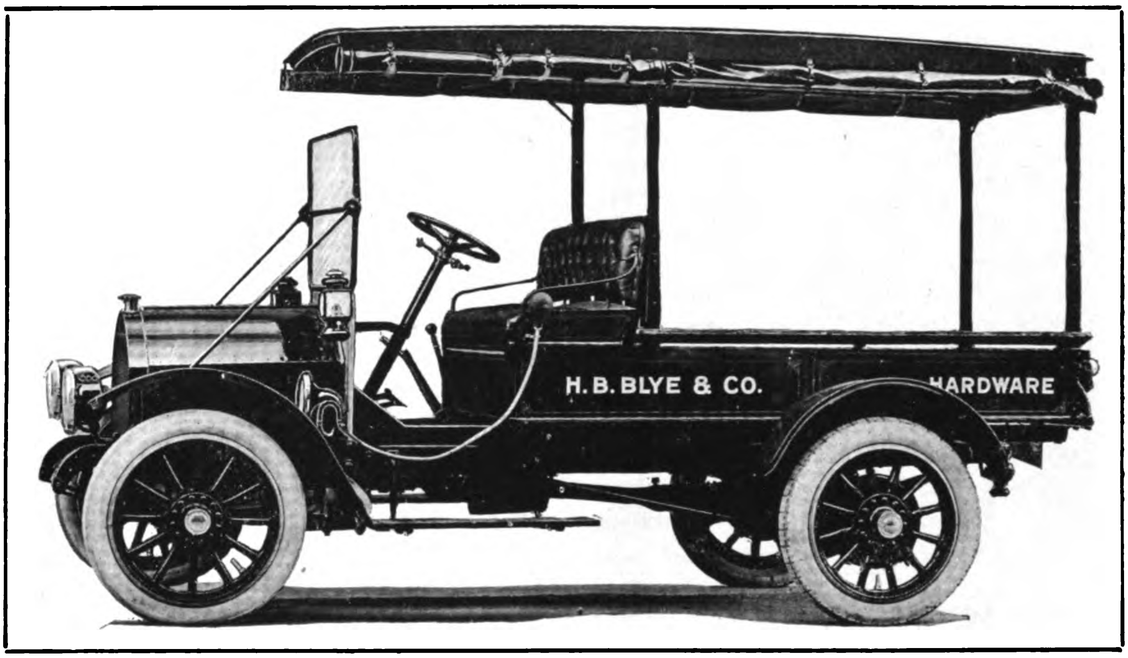
DESIGNED to meet the requirements of New England business men, for fast, light and roomy vehicles that can carry bulky loads, the Howard truck, built by the Howard Motor Truck Company, 87 Church street, Boston, Mass., has many qualities that recommend it to those who make deliveries in areas of considerable size. The machine has capacity of 1500 pounds, is shaft driven, is fitted with pneumatic tires, has exceptional spring suspension, and can be driven rapidly on good roads without deterioration mechanically.

The truck is built of components recognized throughout the industry as standard, the design being primarily with the purpose of obtaining high efficiency at extremely small operating expense. All parts have an ample factor of safety and, being produced by specialists, they can be regarded as guaranteed not only by the builder of the truck, but by the manufacturers themselves. The price has been fixed at $990 with open express body, which is claimed to be the lowest ever named for a machine of this capacity and quality.

The power plant consists of a motor and clutch, with a gearset incorporated with a three-quarters floating rear axle. The motor is a model N Continental, having bore of 3½ inches and stroke of five inches, which is rated by the S. A. E. formula at 19.60 horsepower, but will develop in excess of 25. This is a special type of small, long stroke truck motor that is claimed by the manufacturer to be powerful, extremely economical, and very enduring. It is a four-cylinder, four-cycle, water cooled, L head type, with the cylinders cast en bloc, that was carefully developed to meet the Continental standard. The motor is one of the latest productions of the Continental company and it represents everything that gas engineering has developed as necessary or desirable for truck service.

The engine is cooled by a thermo-syphon circulation of water through the jackets and a Long specially built tubular radiator of extra size, which insures against the engine over-heating excessively. Radiation is promoted by a large fan mounted on the front of the engine block, that is driven by a flat belt. The motor is lubricated by a combination force feed constant level splash system that is characteristic of all Continental engines. The ignition is by an Eisemann high-tension magneto with a fixed spark, and the carburetion is by a Schebler model L carburetor. The motor is mounted on three supports.

The clutch is a Hartford standard cone type design, 13½ inches diameter and with two-inch face, faced with leather and fitted with flat springs to insure easy engagement. The drive is by shaft with two universal joints to a Covert gearset incorporated with the three-quarters floating rear axle. This gearset is a standard sliding gear selective construction that affords three forward speed ratios and reverse, the shafts being large and the gear faces wide, with bearings of liberal proportions. The axles are built by the Salisbury Wheel and Manufacturing Company, the rear axle being especially built for truck service and reinforced with a heavy truss rod. The large bevel gear differential gearset and the driving axles are mounted on generous Hyatt heavy duty bearings. The driving shaft is enclosed in a substantial torque tube that is bolted to brackets mounted on a large frame cross member. The radius rods extend from the rear axle to the frame side members, insuring the protection of the torque tube and shaft against driving and braking thrust. The rear construction is extremely well built and designed to endure hard service.



The Howard 1500-Pound Shaft Driven Delivery Wagon, Built of High Standard Parts and Sold for $990.

The front axle is a heavy I beam, with large steering knuckles and spindles, fitted with ample ball bearings. The frame is a Parish & Bingham production, 150 inches length, of pressed steel channel section, 4½ inches deep and with webs two inches width. This is

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mounted on semi-elliptic springs, 39 inches length and two inches width, with large bushed eyes, shackled at the rear, fitted with hardened and ground spring bolts and grease cups, and full elliptic springs, 35 inches length and two inches width, at the rear. The wheels are artillery type, of wood, with 1½-inch spokes and shod with 32 by four-inch pneumatic tires.

The steering gear is a Ross design, that is installed at the left side, with heavy linkage coupling the forward wheels. The gear shifting and the emergency brake levers are located in the centre of the footboard. There is a throttle lever on the steering wheel. The fuel supply is also controlled by a foot accelerator. The service brake, actuated by a foot pedal, and the emergency brake, operate in and on steel drums 14 inches diameter and two inches width on the rear wheels. The fuel tank, which has 11 gallons capacity, is beneath the driver's seat. The wheelbase is 107 inches, so that the machine may be turned in very short radius, and the tread is 56 inches. The body is 78 inches length and 42 inches width, inside measurements.

The Famed Liberty Bell Starting on Its Transcontinental Journey on a White Truck at Philadelphia, July 4.

The truck as sold is equipped with oil dash and tail lamps, jack, pump and full set of hand tools.

LIBERTY BELL ON WHITE TRUCK.

When it was decided to ship the Liberty Bell from Independence hall in Philadelphia to the San Francisco Exposition, careful consideration was given to selecting the safest means of conveying it to the railroad station.

The representative of the B. F. Goodrich Company suggested that pneumatic truck tires would provide a cushion that was least likely to transmit jars that might further crack the old bell and his suggestion was acted on. The 1½-ton White truck owned by the Goodrich branch in Philadelphia was bedecked in holiday fittings.

The bell was loaded on this vehicle and held the place of honor in Philadelphia's Fourth of July celebration. The bell was taken to the station by a guard of honor, arriving, of course, safe and sound.

PRIZES FOR FEDERAL OWNERS' LETTERS.

The Federal Motor Truck Company offers $300, to be divided in prizes for the best letters on "Why I Bought a Federal Truck." Federal owners are eligible to the competition. The first prize is $100, the second $50, third $25, fourth $15 and the balance $10 each. Letters must not be longer than 500 words and the contest closes Aug. 10.

WEATHER AIDS TRUCK SALES.

Extreme weather conditions are a strong influence in stimulating motor truck sales, in the opinion of C. R. Norton, truck sales manager of the Packard Motor Car Company. Recognition of the effects of extreme heat and cold upon horses by their owners is shown by the following publication in a house organ of one of the largest express companies in the country:

"Now that warm weather is upon us this subject of caring for our horses becomes particularly important. There are two periods of every year that are most distressing to our animals—the extreme cold season and the extreme hot season. The heat does far more damage than the cold. In Chicago a few years ago, when the thermometer was around 100 in the shade for a few days, work horses of every sort and degree died at a rate of 50 a day more than normal."

WATSON PRODUCES FRONT-DRIVE TRUCK.

The Watson Wagon Company, Canastota, N. Y., which for many years has built contractors' wagons, and which recently adapted a type for use as trailers with motor trucks, has begun the production of what is known as a "front drive truck." This is a Walter two-wheeled tractor, supporting the front end of a Watson 7½-ton bottom dump trailer, the whole unit being one rigid vehicle. The front wheels carry the power plant and one-third of the load, while 66 per cent. of the pay load is carried on large diameter steel tired trailing wheels. The power connections are very short and large brakes are attached to the rear wheels. Great tire economy is expected from the fact that only the front wheels have rubber shoes.

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ALLIS-CHALMERS TRACTOR ORDERS.

An order of considerable size for tractor trucks to be used by the Russian armies has been received by the Allis-Chalmers Company of Milwaukee, Wis. The quantity and details of the tractor construction are not known. It is understood that within a few days large orders for additional war supplies will be placed by the American Brake Shoe and Foundry Company, the American Can Company and the General Electric Company. Additional orders are going also to the Canadian Car and Foundry Company according to report.

TRUCK FORCES RATE REDUCTION.

The first instance in which a railroad has applied to the Interstate Commerce Commission for authority to reduce its rates so that it can meet the competition of motor trucks covering the same territory has recently come up in Kentucky, where the Flemingsburg and Southeastern Railroad Company, which operate from Flemingsburg to Johnson, where it connects with the Louisville and Nashville road, asks such relief.

The line is very short and all of its business originates in or is consigned to Flemingsburg. Its rates are based on the regular distance tariffs of the Louisville and Nashville. A 3000-pound truck lately has made regular trips from Flemingsburg to Maysville, which latter city is not affected by the long and short haul rate, but has river rates instead.

The truck carries freight for the 17 miles at eight cents a 100 pounds for full truck loads, and 12½ cents a 100 pounds for small lots of bulky stuff. The complaint points out that the truck is not under the control of the commission, that it has no franchise and pays only a hack line license of $10 and the regular automobile license fees. The railroad asks to be permitted to reduce rates to meet the competition.

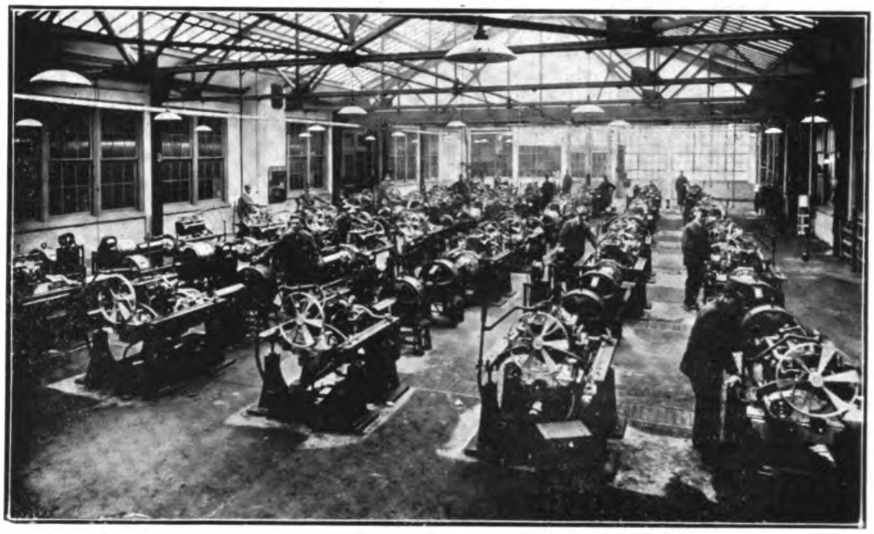
UNITED STATES EXPORTS OF HORSES.

For several years the number of horses exported from the United States has been 28,000 annually, with an average unit value of $142, and 5000 mules have been exported, the averaged values of these being $150. During the 10 months ending with April, 1915, according to the Department of Commerce reports, the export of horses totalled 215,759, valued at $27,783,848, or an average of over $220 each, and 39,229 mules, valued at $7,478,014, or more than $190 per head. As the department has previously pointed out, these animals can easily be spared, as there are in the United States more than 24,000,000 horses and 5,000,000 mules. The big foreign demand for work animals will probably be felt after the war, when they will be needed for farming. It is said that 150,000 horses have been shipped from the St. Louis stock yards to Europe.

WHEEL FENDERS FOR 'BUSES.

All the motor 'buses operated by the Fifth Avenue Coach Company in New York City have been fitted with long wooden safety fenders, which are hung from the side of the car body. They are curved outward toward the rear to keep any person or thing from getting under the rear wheels.

Careful investigation and inquiry in both New York and London demonstrated that most 'bus accidents are caused by pedestrians getting in front of the rear wheels. These fenders are expected to further safeguard the public and better the already excellent record of the company, for only one person is now injured in every 1,500,000 car miles of service. The fenders were prepared by the company in its own shops at a cost of $7.50 a vehicle and were attached by a force of 25 workmen in one night.



The Testing Department of the Packard Motor Car Company's Factory, Where All the Motors are Tested Before Installation in the Chassis.

LIMIT OHIO TRUCK SIZES.

A new Ohio law sets a limit of 3400 pounds for the weight of any vehicle driven on stone, brick or macadamized road which has a tire less than three inches in width. If the vehicle weighs more its owner must secure the permission of the county commissioners before it can use the roads. Flanges and lugs on the wheels cannot be used.

NEW FOUR-WHEEL DRIVE TRACTOR.

The Utility Steel Tractor Company, Antigo, Wis., has developed a powerful four-wheel drive tractor and is completing preliminary tests of the vehicle. It is expected to be ready for the market in August.

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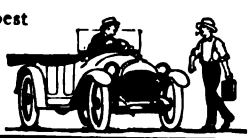

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

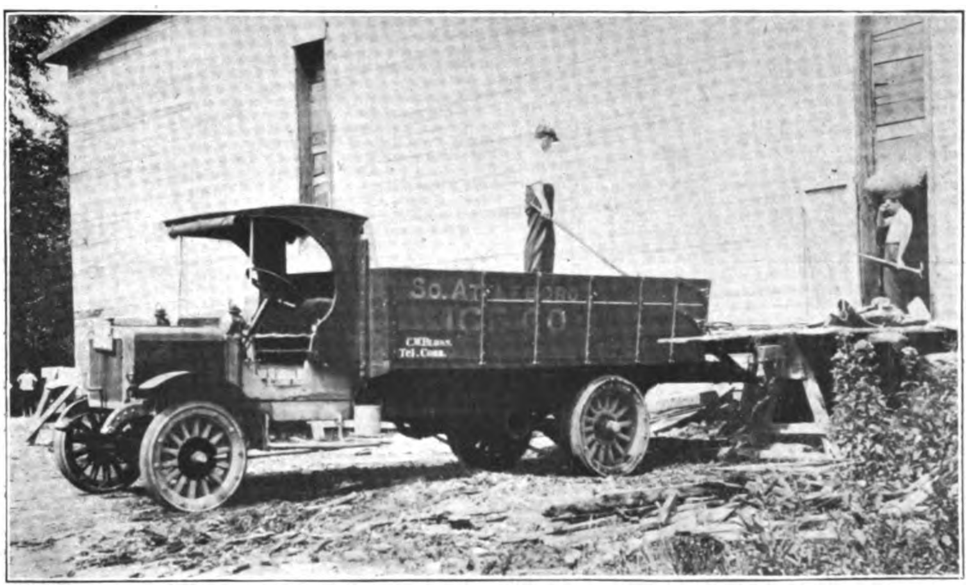
VOL. VI. PAWTUCKET, R. I., AUGUST, 1915 No. 8

STANDARDIZE TOWN'S TRUCK EQUIPMENT.

Community Where All Business Interests Having Heavy Haulage Requirements Have One Make of Machine and the Owners Have What Is Practically Cooperation in Mechanical Maintenance—How Driver Problem Was Solved.

HOW effective is the influence of a good truck in extending power wagon service through a community and stimulating the purchase of other machines of the same make, is illustrated by the development of motor vehicle haulage in the village of South Attleboro, Mass., a suburb of the infant city of Attleboro.

South Attleboro is a community of a few hundred people, four miles from Pawtucket, R. I., and eight miles from Providence. It has two or three factories that manufacture jewelry and only three or four businesses with a sufficient volume of hauling to make the use of trucks a practical business proposition.



Supply Truck of the South Attleboro Ice Company Loading at Ice House.

Although such communities are traditionally conservative, trucks have won their way there very rapidly on a basis of merit. Practically everybody who can use trucks to advantage is using them and is an enthusiastic booster.

The local coal yard operated by the Jencks-Adams Company, brought the first truck to South Attleboro in April, 1914. G. Dallas Jencks, secretary and manager of the company, had previously been manager for a coal company in Providence and had used trucks in that city.

He bought a 1½-ton Service truck and begun work with it. At that time it was the only one of this make in New England. In the summer he did trucking of all sorts, furniture moving and long distance hauling. In the winter he used his truck to deliver coal. He could not meet local demand for haulage with one machine and bought a one-ton Service truck, with which he could accept practically all vicinity patronage.

Ice Company Uses Truck.

The South Attleboro Ice Company, which cuts its ice on a pound near the town and delivers it in Pawtucket, R. I., was operating three supply teams between South Attleboro and that city. It purchased a three-ton truck to replace those three teams after having observed the successful performance of the Jencks-Adams equipment. This is also a Service truck machine.

N. Roy & Son, who gather up dead horses throughout Rhode Island and a large section of southeastern Massachusetts and convert their bodies into poultry food at a rendering plant in South Attleboro, had six teams employed for that work. The company bought a 1½-ton Service truck to make the longer trips.

That completed the motorization of the town so far as it was able to absorb trucks at the time. The Jencks-Adams Company has a mechanical department

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which cares for any of the mechanical needs that may arise and these have been very few. Up to this time practically the only expense for operating any of the installations has been for tires, supplies and wages.

None of the businesses which have adopted the trucks for haulage is elaborately organized and none had ever maintained a detailed cost system. Not one firm knew exactly the cost of its horse service and, like many other truck users, none has kept a detailed account of truck expense. But basing estimate for depreciation on a reasonable length of life for a truck and comparing the total truck expense with that of horses for the same work, the firms are satisfied that not only is truck service cheaper than animal hauling, but that it is much quicker, more convenient and altogether preferable.

How Driver Problem Was Solved.

The problem of getting competent and careful drivers who recognize the mechanical and service

Truck for Hauling Dead Horse Bodies, Showing Special Winch Just Behind the Seat.

value of a truck and drive it rationally, these small town business men have been able to solve much more easily than many large city users. In two cases the owner's son is the truck driver and in the other it is driven by members of the firm.

The trucks of the Jencks-Adams Company, 1½ and one-ton, are fitted with express bodies for express work and hauling coal. These are easily changed for 'bus bodies for passenger work, which is undertaken on a considerable scale Sundays or whenever there is a demand.

The company has specialized in the summer time on long distance moving, although a great deal of expressing of all sorts is done. People who have to move their furniture from one town to another, even long distances, have found it cheaper to load it on a truck at their homes and have it taken directly to their new residences than to pay the expense of crating, expressing or freight.

Much work of this sort is undertaken. Trips have been made from North Easton, Mass., to East Glastonbury, Conn., from Providence, R. I., to Hartford, Conn., from Attleboro to New Haven, Conn., and many loads have been taken well up into New Hampshire. The range of the trucks is limited only by the distance over which a truck can successfully compete with a railroad.

On Sundays the trucks are fitted with passenger bodies, which have canopy tops and comfortably upholstered seats. They are chartered by parties at $25 a day for the 1½-ton truck and $20 for the one-ton. Twenty to 30 people are carried on each truck.

Sunday Trips to Revere Beach.

Every Sunday during the past summer the trucks have taken a party to Revere Beach, near Boston. By the roads over which the machines are driven the distance is approximately 50 miles and the time made one way is slightly less than three hours. Parties are usually landed at the beach before noon and they set their own time for departure. The company has cultivated fraternal organizations and has secured many charters from them to take their members to fraternity doings in towns some distance away.

As both the driving and the care of the trucks is done by members of the firm, cost of labor has not been entered in its expense calculations. One of the trucks has now run close to 25,000 miles. It has been found that the average life of a set of tires is about 12,000 miles—most of the roads travelled are exceptionally good, although occasionally a bad stretch is encountered, and the trucks do about 10 miles on a gallon of gasoline and between 40 and 50 miles on a pint of oil.

Replacement parts purchased for the trucks up to this time have been new sets of chains and sprockets. The Buda motor used in the Service truck has proven itself to be exceptionally powerful and almost trouble proof.

The South Attleboro Ice Company, of which C. W. Bloss is proprietor, has operated a three-ton Service truck through the 1914 season and the greater part of the 1915 season. It is kept in the garage for some months in the winter when the demand for ice is not large.

The company delivers substantially all of its ice in Pawtucket, R. I. The truck is used for supply work. It starts about 5 o'clock in the morning and its first two trips are from the ice houses in South Attleboro to the company's sub-station in Pawtucket.

Six Teams Are Supplied.

Six teams are used to deliver ice to consumers. These return every night to the stables in South At-

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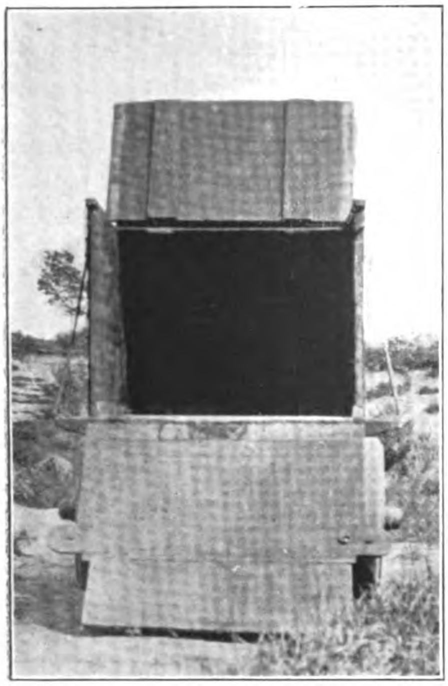


Rear View of Body for Dead Horses Ready for Loading.

tleboro, load at the ice houses in the morning and take their first loads into the city.

Three of the teams, after delivery of the first loads, operate from the sub-station in the down town section of the city near by, depending for supplies on the first loads delivered by the truck.

Three other carts operate in more distant parts of the city. To these the truck runs direct and each truck load is divided up among the three wagons. The truck runs to the sub-station and return are about eight miles, but the trips on which the three different carts are found on their routes and supplied are about 12 miles.

After two or three loads have been delivered to the wagons on the routes it is frequently necessary to haul another load later in the day to the sub-station. An average truck load consists of 55 cakes of ice, weighing in the neighborhood of 150 pounds per cake. So the total load is often considerably over four tons.

The roads, however, are very good, with smooth surfaces and few grades, so that the truck is able to make the entire run to Pawtucket without going out of high gear.

The load can be put on the truck at the ice house in about seven minutes. It takes more time to remove it to the wagons in the city and some time is usually also required to locate the wagons on their routes.

The truck driver, who is the owner's son, and his helper, load the truck at the ice houses. In the city they are aided in transferring the load by the driver of the ice wagon. They have a few minutes of fast, severe work on each trip, with good resting periods between when the truck is under way.

Before the truck was purchased it was necessary to keep three horse teams, with large wagons doing supply work between the ice houses and the teams in town. The truck can haul more ice than three teams.

Relieves Horses of Long Hauls.

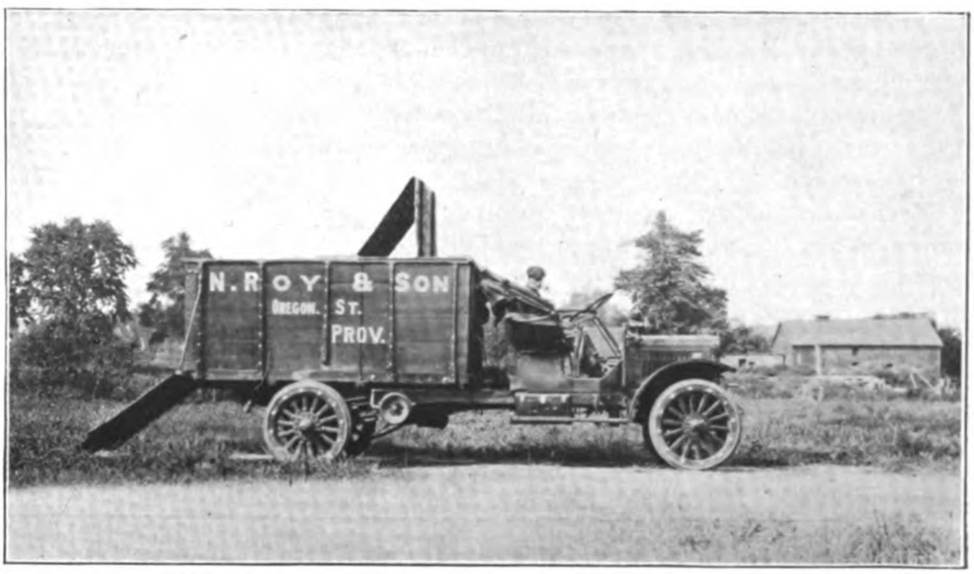
The ice business is a very difficult one for horses, owing to the fact that the largest volume must be done when the weather is hottest and the horses can stand the least. Naturally, it is the long hauls which are the horse killers. When horses were used in supply work it was extremely difficult in hot weather to keep the wagons in town supplied.

The work required of horses in the actual delivery of ice to consumers is not so difficult as they are standing a great deal of the time and the hauls between stops are very short. So the truck not only does more work, but it does the kind of work that it was hardest to do with horses.

Especially hot days do not make the truck service any slower than it normally is, whereas the distance that could be travelled by the horse teams was perceptibly cut down as the temperature went up.

The drivers of the horse supply teams always did their work without helpers, so the truck has actually replaced six horses, with wagons and one man. With only animal equipment there was practically no work for about half the horses in the winter months, so that it was necessary either to sell them at a sacrifice and buy at a much higher price in the spring, or to feed them all winter. In either case, a substantial loss had to be taken.

Now the truck is operated from May to October and then laid up for the winter, with the exception of an occasional job of contract hauling. This, of course, keeps the investment idle during about five months of the year and so is a source of expense, but interest on the truck investment amounts to less than the loss involved in selling, buying or feeding horses at present rates for fodder during the winter months. Laying up the truck naturally increases the length of its life, and at the present rate of operation, if parts are



Dead Horse Truck, Showing How Special Tail Gate Is Dropped and Top Is Opened.

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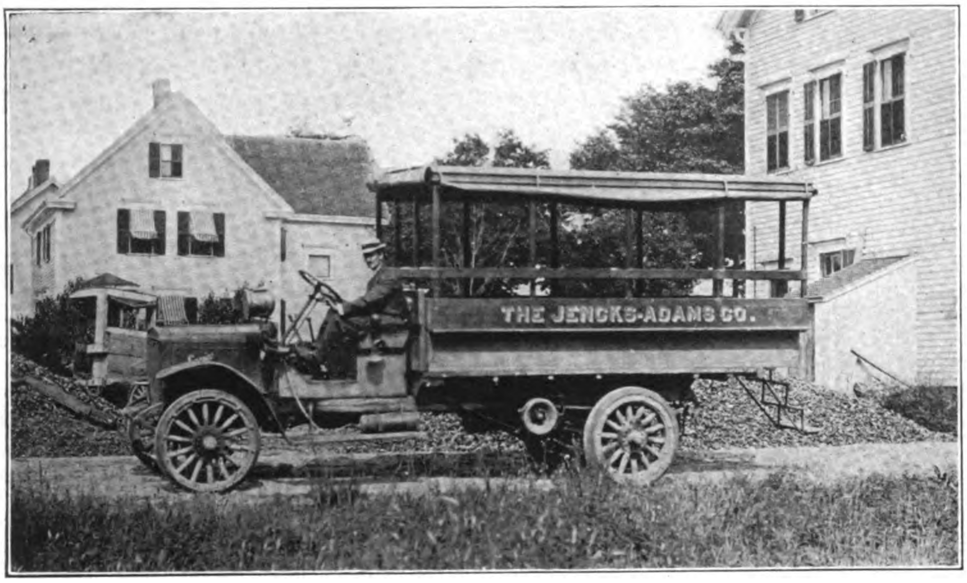
replaced as they show wear, this should be in the neighborhood of 10 years.

Horses Now Kept Earning.

There is some demand for ice during the winter and horses are required for the cutting and storing operations, so that most of the horses that are now used can be kept employed during the dull season of the year. The search for purchasers for the horses in the fall, and in the spring for satisfactory stock, was a source of a great deal of work and annoyance in the past and all that has now been done away with.

This company, like the others in South Attleboro, has not kept a detailed record of its truck costs, nor did it do so with its horses before it used a truck. There is no doubt, however, of the success of the truck installation in an economic way, nor of the greater ease and convenience with which the business is carried on with its service.

The truck, which as has been shown, usually carries an overload, makes from four to five miles on a gallon of gasoline. Up to the time this was written it had been driven for nine months at an average of 40 miles a day, six days a week, or rather more than 9000 miles. The original tires are still on all wheels. These are still in good condition and should last for two or three months more—at least until the end of the 1915 season.



One of the Trucks of Jencks-Adams Company with Passenger Body Mounted.

Mechanical failure is therefore practically unknown. When the truck has been required it has not been out of service more than one hour, during all the time that it has been in operation. It has never been in a city repair shop, but has been kept in the best of condition by the driver and the mechanics of the Jencks-Adams company.

Mr. Bloss has a farm on which his stables and garage are located. An inexpensive, but good garage has been erected near the horse barns and the truck is stored there with very slight expense. The garage also shelters the family touring car.

The experience of the company throughout is an impressive example of the improvement that can be brought about by the country business man who uses a truck for his hauling.

Truck to Haul Dead Horses.

For 25 years N. Roy & Son has disposed of dead horses in Rhode Island and the southeastern section of Massachusetts. The bodies are given the company for the service of hauling them away. The firm has erected a modern rendering plant at South Attleboro, where horses are taken. The hides are removed and sold, the bones are sold, and the remainder of the carcasses made into poultry food, for which there is a good demand.

The company is called upon to haul away from six to a dozen dead horses every day. Before it bought the 1½-ton Service truck six double teams were used to bring the horses to the rendering plant and when calls were numerous much difficulty was experienced in getting all the carcasses to the plant.

Since the installation of the truck two horse rigs have been kept in Providence, which pick up bodies and haul them to the company's Providence yard. The truck goes there once or twice a day—a run of about eight miles one way—to bring out the accumulation. It also makes many trips for individual horses in territory that cannot be conveniently reached by the horse teams in Providence. It makes all of the longer runs.

Truck Expands Business.

The acquisition of the truck has made it possible to cover a much larger territory than the horse teams could have covered and has been effective in expanding the volume of business done in that way. Trips have been made to Bristol and Hope, R. I., and Mansfield, Easton and Sharon, Mass., operating well up toward Boston and all over the State of Rhode Island.

The services of from nine to 11 horses have been dispensed with and the truck does the work much quicker and at a lower cost.

A special body has been designed for the work. It is a high covered box which can be closed all around. Just behind the driver's seat and between the seat and the body is a power winch, driven by the truck motor. This is operated by a worm on a shaft that takes its power through gears from the main drive shaft and the jackshaft.

A cable runs through the front wall of the body out through the open tail gate. This tail gate is fitted with an extension which when attached forms an inclined plane up which the bodies can be dragged into the truck.

The cable is made fast to the dead horse and the

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carcass is speedily loaded into the truck. It has capacity for four bodies weighing about 1400 pounds and for six that weigh in the neighborhood of 1000 pounds. The floor of the body is lined with zinc, to protect the chassis from any fluids and is easily cleaned. The body cross section is four feet four inches square and it is nine feet six inches long.

The truck motor has proven to be exceptionally powerful and ample to haul any load on any of the roads or hills over which the machine is operated. The truck has been in use since May, 1915, and the only expense has been for oil and gasoline.

SUMMARY OF TRUCK OPERATION IN SOUTH ATTLEBORO.

Every truck in town is a Service truck.

Every truck continuously operated at almost negligible maintenance cost. One of the users has a mechanical department which cares for all the trucks.

Simplicity and mechanical perfection of trucks makes operation successful in small town with attention of a mechanic who has not ah elaborate tool equipment.

Trucks have enlarged the amount of business done in the town.

A profitable long distance hauling and passenger business that did not exist before has been created.

In the ice business the truck has made possible the delivery of larger quantities of ice over a greater range of territory in very hot weather when the demand is heavy.

Trucks have made possible the collection of poultry food material over a larger area.

Big economies have been effected.

In the two old established firms the amount of capital invested has been reduced.

Five teams with harness and wagons were replaced in the dead horse rendering business. The estimated value of these is as follows:

10 horses at $275 each	$2750
5 sets of double harness	375
5 wagons	1500
Total	$4625

Cost of 1½-ton truck with special body $2200

In the service of the South Attleboro Ice Company the truck replaced:

Six horses, valued at $275 each	$1650
Harness	225
Three ice wagons	1200
Total	$3075

Cost of three-ton truck $2975

The trucks have cut the cost of delivering coal. They have stopped losses due to buying horses in the spring and selling in the fall or feeding all winter.

MORE CARS THAN HORSES.

Oklahoma City, with a population of nearly 100,000, is one municipality where there are already more motor cars than horses. This is one of the newest and, therefore, least conservative of all the cities in the United States, and in a section of the country where horses would be believed to be both cheap and plentiful.

According to the records of the county assessors there are 1900 motor cars in that city. Horses number only 1343, valued at $66,350, and there are 75 mules, valued at $4435. In spite of the fact that there are only 100 cars in the county outside of the city, the total value of the cars in the county is greater than that of the draft horses.

STEARNS-KNIGHT TRUCK

First Machine Built in America with Sleeve Engine.

The chief features of the new Stearns five-ton truck are the Knight motor, the first to be installed in a truck in America, and a double frame arrangement designed to protect the mechanism when running light from shocks transmitted by the stiff springs that carry the truck load.

The power plant is suspended on an independent sub-frame supported at the front on inverted semi-elliptic springs resting on the main frame brackets and at the rear on large jackets from the jackshaft housing. The cab and control are mounted on the sub-frame also, so that the main frame carries only the load in transit.

So far only the five-ton model has been built. With 144-inch wheelbase the price is $4500, and with 180-inch wheelbase $100 is added. The final drive is through side chains. The front tires are 34 by five-inch and rear 38 by five-inch dual.

The motor has a bore of 4¼ inches, a stroke of 5½ inches and the S. A. E. horsepower is 29 at 1000 revolutions a minute. The maximum speed is 12 miles per hour. The cylinders are cast in pairs. There is a centrifugal pump and a cellular radiator and fan in the cooling system. A Stromberg carburetor and Bosch double ignition are included.

The clutch is a dry plate type, with four discs, faced with Raybestos. The gearset, differential and jackshaft are made up into a unit. There are four forward speed ratios and reverse. The jackshaft is fitted with a differential lock, which consists of a dog clutch acting between the right jackshaft axle and the differential casing. It is enclosed and is operated from the cab. Another gearset feature is a power take off on the lay shaft. The springs are half elliptic and are mounted on friction plates instead of shackles. The frames are both of channel rolled steel and are rigidly braced and gusseted. The foot brake shoes expand in drums on the ends of the jackshafts outside the sprockets, and the emergency brake shoes expand in drums on the rear wheels. Centre control is used.

The Detroit Motor Transportation Company is the name of an organization recently formed by W. G. Wagenhals, treasurer of the Wagenhals Motor Car Company of Detroit, for the purpose of manufacturing 10-passenger "jitney" 'buses.

The Republic Motor Truck Company, Alma, Mich., according to General Manager F. W. Ruggles, during the fiscal year increased its truck sales 800 per cent. Of the total production 95 per cent. was consumed in the United States.

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MACK TRUCKS AT ARMY CAMP.

Citizen Soldiers' School Use Special Equipment Loaned by Builder.

At the encampment at Plattsburg, N. Y., of the United States Army School of Instruction are two armored Mack trucks that are attracting much attention from the demonstrations of their efficiency. Among the citizen soldiers receiving instruction in modern war tactics under governmental tutelage are some of the leading business and professional men of the country,and they are giving special attention to the machines with a view of possible adaptation to their respective requirements. It is related that John Purroy Mitchell, mayor of New York City and one of the "students," is particularly interested in the possibilities of using similar trucks in suppressing street riots, strikes and other troubles that may arise in the metropolis.

The trucks were loaned to the government officials by the builder, the International Motor Company, New York City, so that the men would have practical demonstration of what service motor trucks can afford under the most adverse conditions. The equipment was especially designed by A. F. Masury, chief engineer of the International company, who studied modern war conditions and their requirements in Europe, where the company is supplying trucks for actual war service.

Specially Equipped Mack Trucks Loaned by the International Motor Company for Use of the Training Camp of Civilian Soldiers at Plattsburg, N. Y.

The largest truck has 3½-ton capacity and draws a trailer consisting of a regulation United States army three-inch field piece with limber. When fully loaded the truck carries two machine guns, 15,000 rounds of machine gun ammunition and 800 rounds for the three-inch gun.

The smaller truck is the standard International one-ton model AB, and as part of its equipment carries a Colt rapid fire gun and ammunition and crew.

An unusual feature in armored motor trucks is that the armor of the Mack machines can be removed to form a temporary protection for the men operating the machine guns. The tops are tarpaulins and are removable.

The crew handling the trucks at Plattsburg include a professional driver and a first class mechanic, supplied by the International company; an army sergeant and men mostly from Squadron A, New York National Guards.

HARDWARE MEN TO SELL ACCESSORIES.

That the American Iron, Steel and Heavy Hardware Association intends seriously to undertake the distribution of automobile accessories is shown by the appointment of a committee representing leading firms in different sections of the country who will receive propositions from manufacturers regarding distribution through the association.

WANT GASOLINE PRICE INVESTIGATION.

The reasons that underlie price making for gasoline have proved to be very baffling to motorists and numerous investigations are under way to find out why prices are what they are in various places.

Recently in Texas and Oklahoma on the same day prices were advanced by a number of different oil companies. This simultaneous action was taken to indicate a concerted movement and the attorney generals of the two states at once started investigations.

Buffalo is much disturbed over the fact that it has to pay 15 cents a gallon for gasoline, while it is sold in Detroit for 10 cents. Motorists of that city and of New York state have brought the matter before the American Automobile Association and have offered to give any aid in their power to United States District Attorney John D. Lynn of Buffalo, who has announced his intention to begin an investigation. It is likely that the attorney general of the State of New York will be called upon also to aid in the probe.

The United States Rubber Company and the United States Tire Company have adopted a policy of encouraging their 55,000 employees to join the militia and naval reserve by giving them leave of absence with pay for military duty and permitting them in addition to have their regular vacations.

The supreme court of Georgia has decided that the law requiring a registration fee of $5 from auto owners is invalid because of the provision that the proceeds be divided among the counties according to the number of miles of rural roads in their borders.

The Hercules Buggy Company, Evansville, Ind., has begun the manufacture of bodies for small capacity motor trucks. About 150 men have been added to the working force. An additional building is planned.

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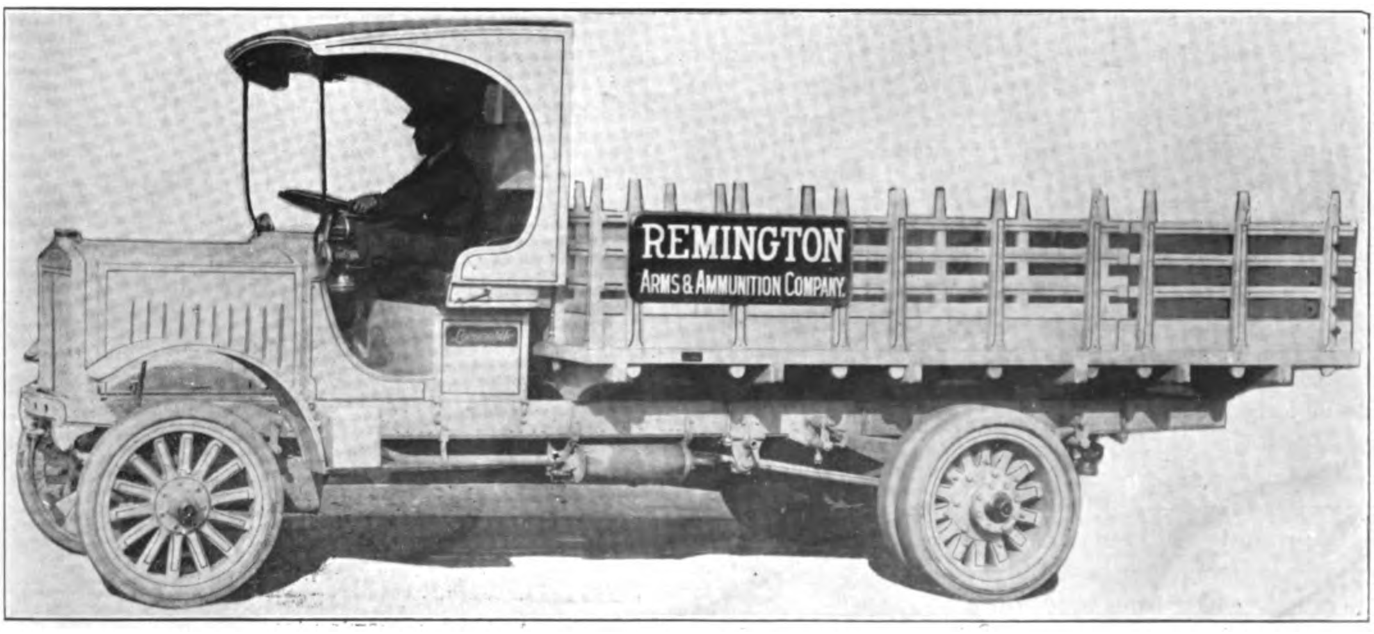
CLAIMING that the very general use of chrome nickel steel in the construction of its new type three and four-ton worm driven trucks is an investment, which the buyer will pay for because he has to, but having paid for, will get the benefit of in longer life, greater reliability, large economy and, with these, an extreme measure of satisfaction, the Locomobile Company of America is now building machines in which more of this metal is utilized than in any other vehicles produced by the American industry.

The company has for years specialized pleasure cars and a standardized five-ton truck, and having decided to construct smaller capacity trucks, a standard design was adopted in which the character and quality of the material is the best that can be obtained. Statement is made that the extensive use of high-grade material was decided after careful consideration of the requirements of highway haulage, for, as all motor trucks are intended to economize time and money, that truck which saves the most time and most money is the best. The new type trucks are designed to be extremely enduring and economical.

Constructed of Special Metals.

To better emphasize the extent to which chrome nickel steel is used, statement is made that the crankshaft, connecting rods, camshaft, connecting rod bolts, clutch pinion, all sliding gears, countershaft, countershaft gears, countershaft bolts, differential bevel pinions and gears, frame, all spring bolts, spring link pins and other components are of this metal. These are given varying heat treatment to develop the special qualities of endurance desired. No less than seven different grades of chrome nickel steel is used in forgings and bar stock.

But besides this lavish use of this high-grade metal, special bronzes are as carefully selected for dif-



Locomobile Four-Ton Chassis Equipped with Stake Platform Body as Furnished to Remington Arms and Ammunition Company.

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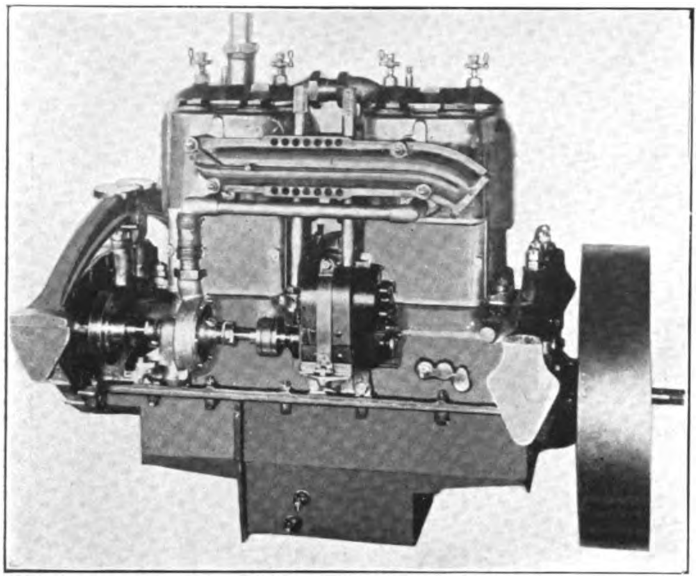


Left Side of the Motor, Showing the Magneto and the Water Pump.

ferent requirements. For instance, the gearset case is a manganese (or vanadium) bronze casting, the crankcase is government bronze, the worm wheel is a special hard phosphor bronze, and all the camshaft bearings, magneto couplings, throttle valve, torque bar bushings, spring chair bushings and valve tappet guides and many other parts are phosphor bronze castings, while the water pump bushings, steering block, spring bushings, oil pump gear, governor valve and other parts are cut from phosphor bronze bar stock.

In general appearance the chassis are conventional, the design being what has common approval, and the frame is low, a result of construction with long, flat springs and medium sized wheels and tires, this affording a minimum height of the centre of gravity. As the chassis are worm driven, they are practically noiseless.

Motor a T Head Type.

The motor is a vertical four-cylinder, four-cycle, water cooled, T head type, with bore of 4¼ inches and stroke of six inches, having a greater stroke to bore ratio than is usual in truck motors, this being 1.41 to one. By the S. A. E. rating the motor will have 28.9 horsepower, but at 1150 revolutions a minute, at which the governor is set, 42.5 horsepower is developed. All parts used in building the trucks are built in the shops of the company.

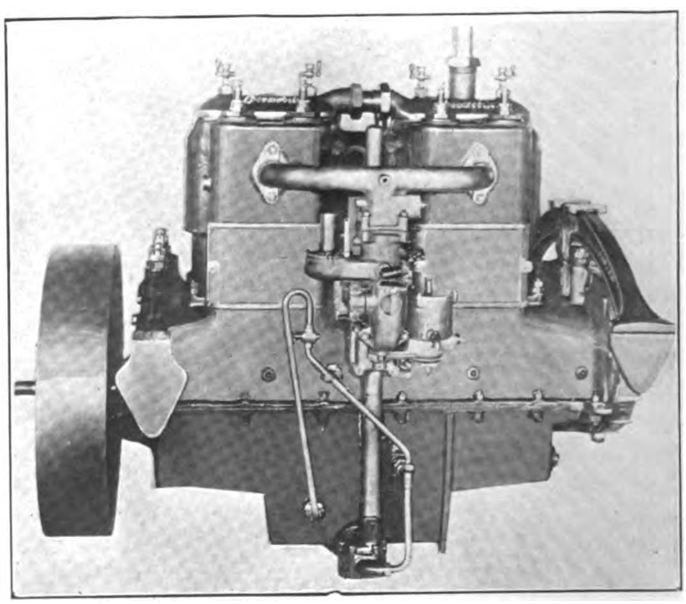
The cylinders are cast in pairs from a fine quality of gray iron, the intake valve being at the right and the exhaust valve at the left. The cylinder units are cast with the water jackets integral and are a detachable head type. This construction insures minimum labor in cleaning, the water jacket connections are simplified, and in assembling all combustion chambers are carefully calibrated and the heads and cylinder units are pairs from the results of the calibration. The pistons are cast from gray iron and are fitted with five gray iron rings, four of these being compression rings above the wristpins and the other an oil ring at the bottom. Each ring is machined from a separate casting to insure perfect material and certain quality. Great care is taken in calibrating the pistons to obtain exact fit and high operating efficiency, and they are paired in sets of exactly equal weight.

Crankcase a Bronze Casting.

The crank case is of government bronze, which has many advantages for strength and toughness as compared with aluminum. The upper half of the case carries all the main and the camshaft bearings, there being a camshaft at either side. The crankshaft is chrome nickel steel, specially heat treated, having a tensile strength of 118,000 pounds and an elastic limit of 81,000 pounds, an elongation of 18 per cent. and a reduction of area of 48 per cent. The shaft is forged, machined all over and ground. The bearings are 2¼ inches diameter and the crankpins are the same size; unusual dimensions for a shaft of this material and used with a motor of so small bore. The bearings are bronze composition shells, lined with high-grade babbitt and are five in number, the second and fourth being each two inches length, and the first, third and fifth, from front to rear, being respectively 4¼, 3½ and 4 11/16 inches length, this being a total of 16 7/16 inches bearing length and a projected total of 36.5 square inches. The crank pin bearings are 2½ inches long, each having a projected area of 4.63 square inches. At the rear end of the shaft is an integrally forged flange, to which the flywheel is attached by six chrome nickel steel bolts that are fitted in hardened steel bushings that take the drive, the bolts merely coupling the flywheel and shaft. Both shaft and flywheel are tested on a running balance machine and corrected for perfect balance.

Connecting Rods Chrome Nickel Steel.

The connecting rods are chrome nickel steel drop forgings, with wristpin bushings of phosphor bronze forced in by pressure, and the big end bearings are



Right Side of Motor, Showing the Carburetor and the Oil System Pump.

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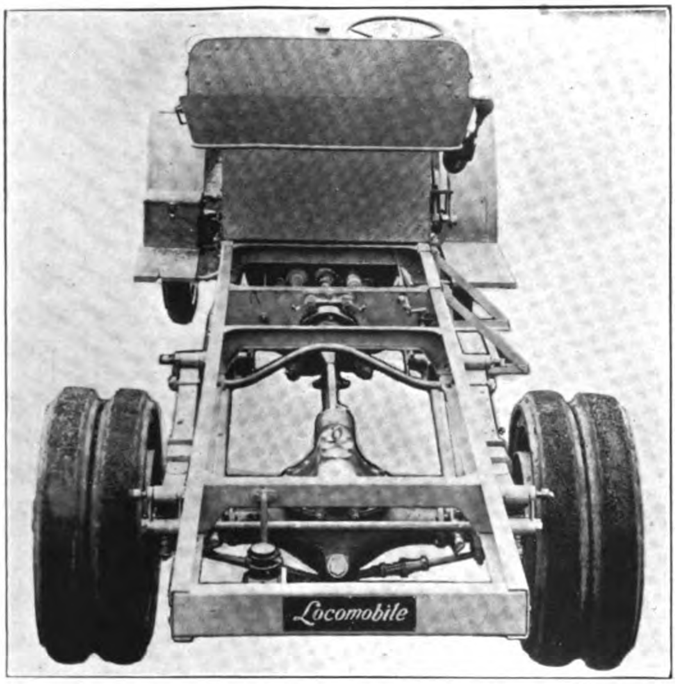


Rear View of Chassis, Showing the Heavy Frame, Driving System and Rear Axle.

bronze shells lined with babbitt. The wristpins are hardened and ground and are driven into the pistons, being retained by two steel studs through the piston bosses. The camshafts are drop forgings, heat treated, hardened and ground, with the cams integral with the shafts. The cams have wide faces to insure against wear. The shafts are each mounted on four phosphor bronze bearings. The valve tappets are hardened and ground steel members, carrying a roller at the lower end and the usual adjusting screw and lock nut at the top, that are operated in phosphor bronze guides mounted in the base flanges of the cylinder units. The valves are usual poppet type, made of tungsten steel, that seat in ports 1¾ inches clear diameter. The valve stems are carried in long guides in the cylinders. The valve mechanism is enclosed from abrasives, water and the entrance of any object by aluminum housings.

The timing gearset, consisting of the crankshaft, two camshafts, the magneto shaft and the water pump shaft gears, have wide faces, are of specially treated steels and cast iron, and are spiral cut. They are enclosed in an aluminum case and operate in a bath of oil.

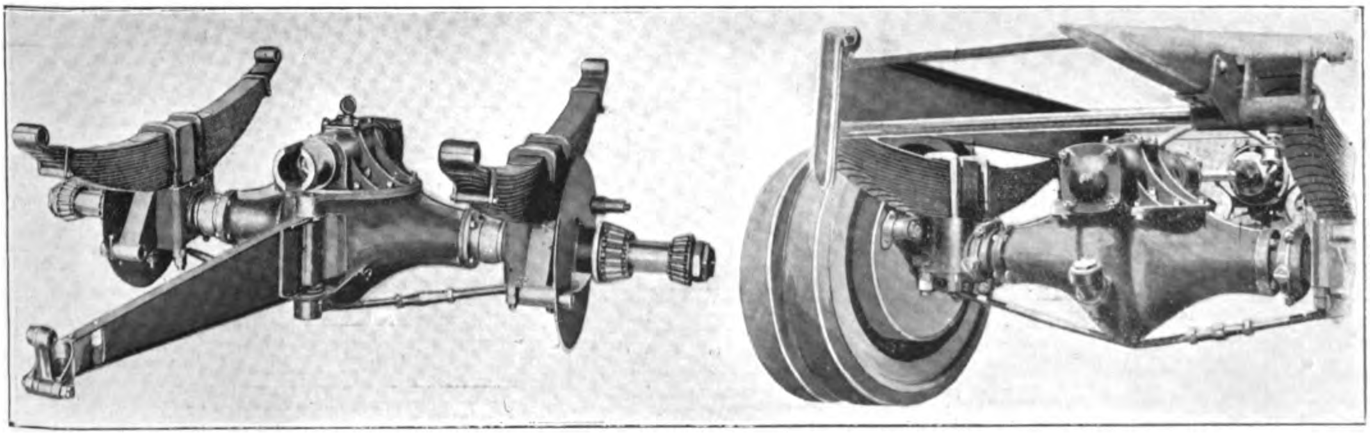
The Lubricating System.

The lower half of the crank case is an aluminum oil pan, which may be dropped for inspection or adjustment of main bearings. The engine is lubricated by a gear driven gear pump, installed outside the crank case and oil pan. It receives its supply from the sump in the pan, forces it through a supply pipe to two tubes, one in the pan from which the connecting rod troughs are filled, the other in the upper half, which lubricates the main bearings through drilled holes. This in turn lubricates the shaft, while a small pipe connection at the front end supplies the pump and magneto shaft bearings. The main supply pipe, in which is a cock, leads back to the sump. An excess of oil is pumped at all times, and when the bearings need more lubricant, as when rescraped and set up, the cock is closed and all the oil must pass through to the bearings. Normally it is open. Another detail is the design of the connecting rod troughs, which slope upward at an angle. When the truck is descending a grade, the excess oil flows over the low front end and there is less for the rods to splash in; when ascending, the high back holds more oil for the rods to splash. This automatically regulates the oil supplied to the cylinders and moving parts and makes for economical consumption without complication.

The Motor Cooling System.

The motor is cooled by water circulated by a gear driven centrifugal pump, located forward on the left side of the motor. There is a packed joint on either side of the pump housing and the pump may be removed without disturbing other units. This feature of individual unit removal obtains throughout the chassis. The radiator is a honeycomb type, with the unusually large frontal area of 700 square inches, with a very large and low filling cap of hard rubber, and it is supported on trunnions of the ball type, those in turn resting upon very thick rubber buffers, so this unit is well protected against road shocks. It is cooled by a fan on an adjustable bracket that is driven by a belt from V grooved pulley on the pump shaft.

Fuel is supplied by the company's carburetor,



The Locomobile Worm and Gear Wheel Rear Axle: At Left, Front View Without Wheels; Showing the Truss and Torque Bar; at Right, the Complete Assembly from the Rear as Installed in the Truck.

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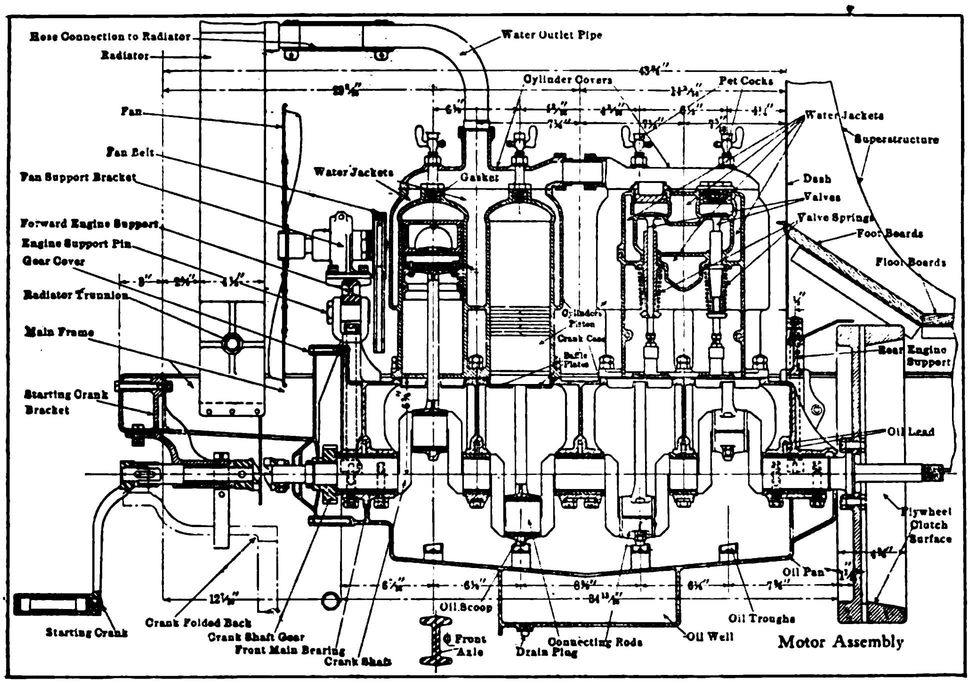


Sectional Drawing of the Locomobile Motor, with the Principal Components Designated.

magneto is located at the left side of the motor, back of the pump, and is driven by an extension of the pump shaft, through a universal coupling which allows of immediate removal and quick replacement. A strap fastening facilitates this.

The flywheel has unusually large diameter, 20 inches, and houses the clutch, a plain leather faced cone. The cone is pressed steel, 18½ inches mean diameter, fastened to the transmission gearset driving shaft by six large diameter bolts, the stress of the drive being taken on hardened steel sleeves surrounding them. The spring is a square section, enclosed, and self-contained as to thrust. Back of the clutch is a double flexible coupling and a clutch spinning brake. The former cushions the drive in case of sudden engagement and disengagement of the clutch, thus preventing stress upon the gears and shafts. The housing may be opened by removing six bolts, and by taking off these and the clutch bolts, the clutch can be removed without affecting other units. Similarly, by the removal of these six bolts, and loosening its support bolts, the transmission gearset may be removed.

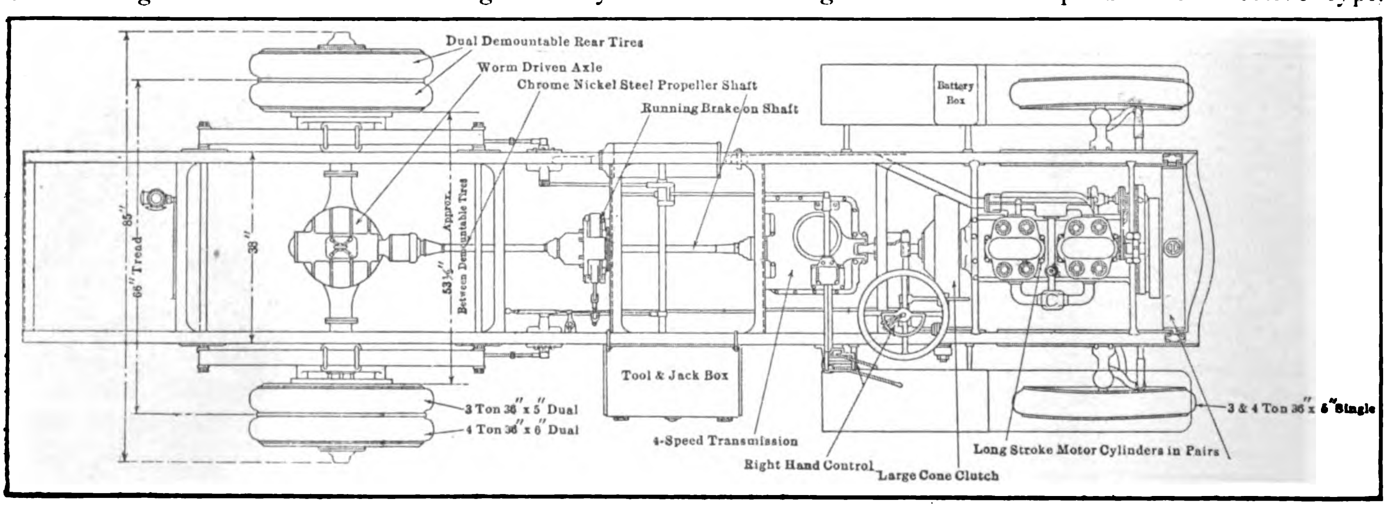
The motor is suspended in the chassis frame at three points, from a pair of forged steel beams, there being a single point of suspension at the front end. This forward trunnion is a chrome nickel steel pin on which the motor may swing, but the ends of the rear beam are fixed in the chassis frame. The beams are supported from the frame, so that the motor may be dropped out of the frame, a work that can be done in a few minutes.

which is designed especially for this motor and for heavy service, and to the same principle as the carburetor used for the last four years with great success on all Locomobile pleasure cars. This has a single central stand pipe, in which the low and medium speed demands are supplied through openings at the centre of the venturi, while the high speed demand is supplied at the top. The usual Locomobile air regulating spring is used, with a dash pot to reduce the fluctuation. After the standpipe has been set and proven correct, it is sealed in place. There are two throttles in the pipe connecting the carburetor and the manifold, the upper operated by the governor, the lower controlled by a hand throttle lever and a foot accelerator pedal. The governor, which is on the inlet side of the truck, midway between the cylinder blocks, is driven by spiral gears off the inlet camshaft, and is of the ball type. This is set at a speed of 1.150 revolutions per minute, and after setting is sealed.

The ignition system is a Duplex type, using a Bosch magneto and a Willard storage battery. The

The Gearset and Driving Shaft.

The gearset is a four-speed ratio selective type.



Plan View of the Locomobile Chassis, with the Principal Components of the Assembly Designated.

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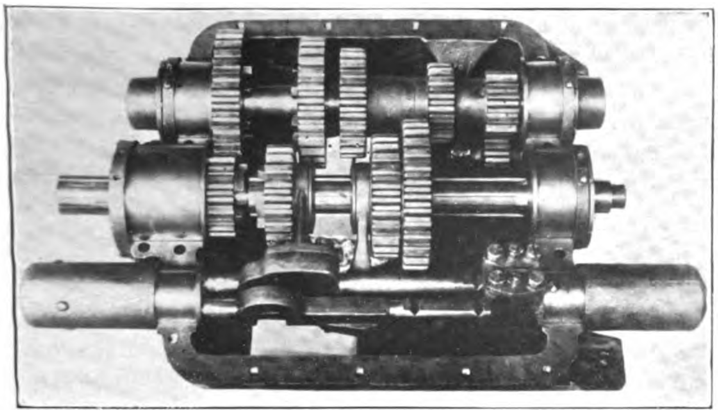


Top View of the Locomobile Four Speed Ratio Transmission System Gearset.

suspended three points in the centre of the chassis. It is constructed with chrome nickel steel gears, shafts, shifting forks and rods, bolts, support bolts, etc. Each of these parts is forged and heat treated. Four speed ratios are considered necessary in truck construction, affording wider range of vehicle speed and particular advantages in hill climbing, in city traffic, etc. In addition, this design has marked economy not to be overlooked in what is essentially an economizing vehicle.

The drive is by a shaft, forged from chrome nickel steel, that lies in a true horizontal line. The shaft is divided, has an internal-external gear coupling at the forward or transmission end, a full universal joint just back of the central bearing, and a full universal joint at the rear axle. With this construction either section of the shaft can be removed without disturbing the other. At the central bearing is the running brake, operated by the right foot pedal. It is small in diameter, but working through the final drive has the advantages of the 8¾ (or 10 to one) reduction gained thereby. The hanging of the shoes is such that they are self-adjusting, but with a convenient set screw hand adjustment can be made when desired. An additional large wing nut affords means of quick tightening. An external fan keeps the brake drum cool.

The Full Floating Rear Axle.

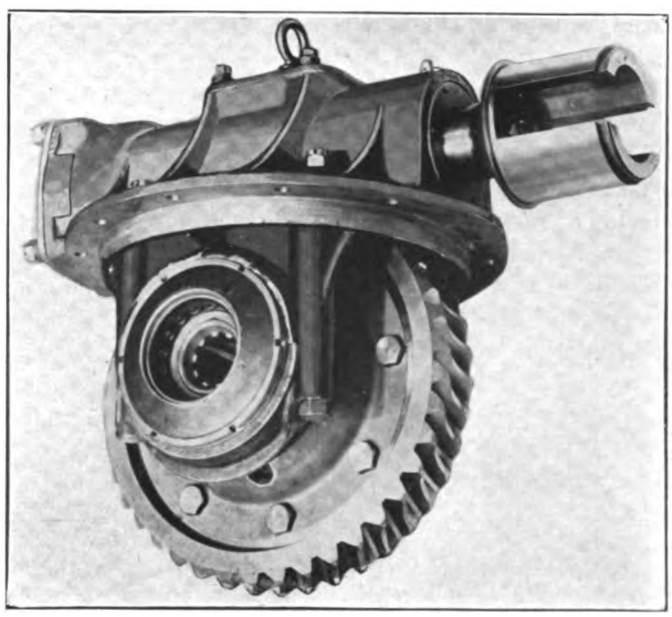
The rear axle is a full floating type, driven by an overhead worm and gear wheel. The worm gearing and differential assembly is enclosed in a cast steel housing, into which the axle tubes of heavy gauge nickel steel are forced by hydraulic pressure and riveted. The central section of the housing encloses the worm, gear and differential, the bearings being held in the cover, a steel casting, which is readily removed as a unit from above. To facilitate removal, a large steel eye is fitted in the centre of the cover for attachment of the crane hook. Inspection can be made by removing a central cap, held by four bolts, while the worm wheel thrust bearing adjustment is made by taking off a cap at the rear, held by three bolts.

The worm is a straight sided type, with 8¾ to one reduction on the three-ton and 10 to one on the four-ton truck. It is made of chrome nickel steel, forged, machined, hardened and ground to a true surface. The wheel is a specially hard phosphor bronze, almost twice as strong as ordinary phosphor bronze. The worm is mounted on a pair of annular ball bearings, with an imported, double-ball, spherically-seated thrust bearing. The gear, which encloses the bevel differential, is similarly fitted with an annular and spherically-seated ball thrust bearing on each side. The worm is lubricated by internal circulation, the bottom of the housing forming a natural pool for several quarts of lubricant, which is carried up to the worm by the rotating wheel. A suitable filler is provided, an oil level testing plug and a drain plug. The driving reaction is taken back to the frame by a heavy channel section pressed steel torque bar, with a chrome nickel steel link at the forward end. This is placed immediately below the driving shaft, and is pivoted on the rear axle housing on a pin of unusual diameter, with two very large phosphor bronze bearings. With this construction the bar carries the torque, but resists no other forces.

The Rear Wheels and Brakes.

Each rear wheel rotates on a pair of large Timken roller bearings, mounted on the exterior of the axle tube. These are set a considerable distance apart to give adequate support. Within them the chrome nickel steel driving shafts drive the wheels through splined ends, which mesh with similar splines in the wheel caps. The latter are also forged chrome nickel steel, and are held to the hubs by chrome nickel steel bolts. Removing these bolts allows of shaft removal.

The rear wheels carry brake drums of unusually large diameter, within which are the emergency brake shoes of expanding type. These shoes have a working diameter of 19¼ inches, and a width of 4½ inches, a total effective braking surface of 320 square inches. The drums are held to the wheels by a separate set of bolts, and may be removed separately.



The Worm Shaft and Gear Wheel Assembly of the Rear Axle Removed from the Housing.

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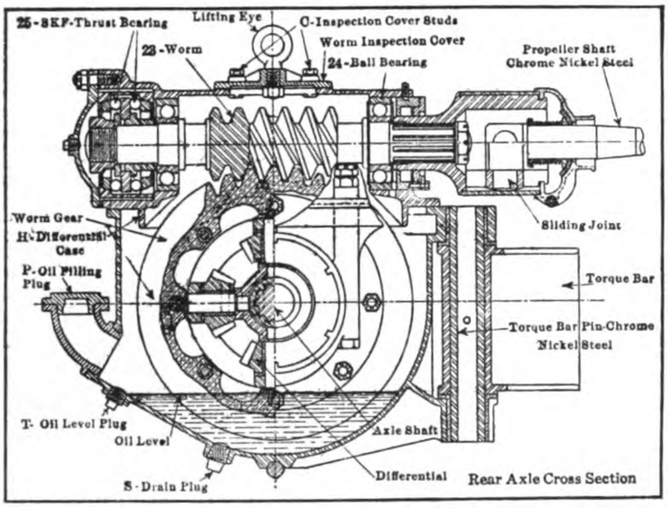


Cross Section of the Locomobile Rear Axle, Showing Detail of Worm and Gear Wheel Assembly.

Distance rods at either side carry the driving effort, these being of large diameter, heavy gauge selected steel tubing, with forged ends being spherical seats on the axle and at the frame. They are held by caps and large diameter bolts, so removal is both quick and easy. Their length is fixed, however.

Springs and Steering Gear.

Both front and rear springs are a very flat, semi-elliptic type, the former mounted over the front axle beneath the frame, and the latter, over the axle, but outside the frame. The front spring setting gives a wider steering lock, while the rear spring installation affords a more stable support, the centre to centre distance of the rear set being 10 inches greater than that of the front set. The front springs are shackled at the rear ends, and the rear springs at both ends. All spring shackle bolts are hardened and ground chrome nickel steel and hollow, with grease cups at their outer ends. Throughout the chassis there is ample provision for sufficient lubrication, by large and accessible grease cups, there being a total of 33 grease cups, as well as numerous oil holes. More rear spring plates are used on the four-ton chassis to carry the extra load.

The steering gear is a screw and nut type, placed on the right side, with inclined steering post. This design was selected because of the greater wearing surface which the screw and nut type gives. The wheel is 22 inches diameter. The steering connections are fitted with springs to take the road shocks. The driver is behind the motor, which is under a bonnet. The gasoline feed is by gravity type, from a 32-gallon tank under the driver's seat. The tank is the bolster or modified rectangular shape, constructed from tinned terne plate with a coating, weighing 15 pounds to the 100 pounds of steel. It is reinforced by internal flanges, and has a strainer on both inlet and outlet.

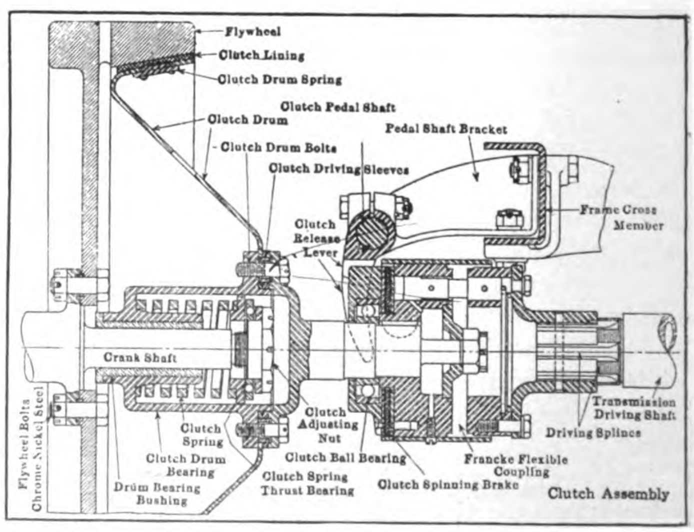
Feature of Frame Construction.

The frame is said to probably represent the greatest advance in truck construction made in recent years. It is a rigid type, constructed from a special chrome nickel alloy pressed steel, heat treated to produce a tensile strength of about 140,000 pounds. It has straight sides of unvarying width of 2¼ inches, and a thickness throughout of 3/16-inch (No. 7 U. S. S. gauge). The side members vary in depth with the load distribution from four inches front and 5½ inches rear to a maximum of 6⅞ inches. The seven cross members are the same material, quality, thickness, etc. All holes are drilled and reamed, and wherever a cross member is rivetted in, an additional reinforcing channel of No. 11 gauge (⅛-inch) is placed inside the main channel, between it and the cross member. Where the transmission gearset supporting cross members are fitted there is additional angle reinforcement. The two engine cross members are bolted on, with aluminum filler pieces, and are in addition to the seven permanent cross members.

For the long wheelbase chassis, the extra long frame is made from a stronger and more rigid stock, the thickness being increased by 25 per cent., making it ¼ inch, and the depth is similarly increased to seven inches. This applies to all cross members as well. In both chassis the front member is curved forward slightly to serve as a radiator protector.

Wheelbase, Length and Load Capacity.

The general specifications show a wheelbase of 150 inches as standard, this having an overall length of 234¼ inches (19 feet 6¼ inches). The extra long chassis has a wheelbase of 170 inches and an overall of 270¼ inches (22 feet 6¼ inches). Both have front tread of 60 inches, rear tread of 66 inches, width overall of 85 inches, frame height loaded 33 inches, platform widths up to 78 inches (six feet six inches), platform lengths of 146 inches (12 feet two inches) maximum standard, and 182 inches (15 feet two inches) maximum extra long, with no body overhang allowed at the rear. The maximum speed with 8¾:1 worm is 14.07 miles an hour, and with 10:1 worm, 12.31 miles an hour. The tire equipment is 36 by five-inch shoes all around on the three-ton, singles in front and duals in the rear; 36 by five-inch shoes front and 36 by six-inch dual shoes on the rear wheels of the four-ton chassis. All tires are demountable; all



Longitudinal Section of the Locomobile Clutch Assembly, Clutch Brake and Flexible Coupling.

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wheels are wood, but steel wheels will be furnished as an extra at $100 the set of four. The price of the three-ton chassis only is $3500 and of the four-ton chassis $3650, f. o. b. at Bridgeport.

One result of the liberal use of extremely strong materials throughout is the low weight, this being but 6800 pounds for the three-ton and 7070 pounds for the four-ton chassis. The total weight allowance for the former is 8000 pounds, allowing a 1200 to 2000 pound body, and for the four-ton chassis 10,000 pounds. With a 2000-pound body in each case, the weight distribution for the three-ton is 36.8 per cent. front and 63.2 per cent. rear empty, 24.8 per cent. front and 75.2 per cent rear loaded, giving for the load only 7.7 per cent. in front and 92.3 per cent. in the rear. For the four-ton chassis the empty distribution is the same, but loaded it is 21.8 per cent. front and 78.2 per cent. rear, and with the load alone 7.2 per cent. front and 92.8 per cent. rear.

CONTINENTAL MOTORS FOR MANY USES.

Although most of the product of the Continental Motor Manufacturing Company is used to drive passenger cars and trucks, motors produced by the company, of which there are now 200,000 in use, are applied also to other purposes. Many are installed in motor boats, a special design is supplied to a maker of motor lawn mowers. Heavy models of new design have been used in many recent developments in farm machinery. Many fire departments use them for pumping, hoisting water towers and such work. They are used in mines for driving pumps that keep the mines dry. Inspection cars on railroads are now usually power driven and Continental motors have been built for this purpose for several years.

MORELAND BIG BUYER OF PARTS.

The Moreland Motor Truck Company of Los Angeles, Cal., recently purchased through Watt Moreland, general manager, many car loads of parts in the East. He bought five car loads of axles and worm gears from the Timken-Detroit Axle Company and a large number of truck motors from the Continental Motor Truck Company, both of Detroit, and many gearsets from the Brown-Lipe-Chapin Company of Syracuse, N. Y. A large number of pressed steel frames and Ross steering gears completed the purchase.

TIMKEN-DETROIT BUYS NEW PLANT.

The plant of the Detroit Metal Products Company has been purchased by the Timken-Detroit Axle Company. The former company is to be dissolved. Receipts from the sale of the plant will be sufficient, it is said, to pay the stockholders in full.

AMERICAN LOCK-NUT BOOKLET.

The American Lock-Nut Company, Chicago, has issued a booklet describing, illustrating and explaining the use of its patent lock nut, which locks the nut so firmly to the bolt that no degree of vibration can work it loose. A slot which is deeper on one side than the other is cut in the side of the nut and a small roller fits into this slot. When the nut is screwed on the roller turns with it. Any force that tends to unscrew the nut causes the roller to roll up the incline of the slot in which it lies and binds the nut tighter and tighter to the bolt. To unscrew the nut a nail or other implement will force the roller to the deeper side of the slot, and then the nut will come off easily. The device has been thoroughly tested in railroad laboratories and has been adopted by many railroads. It is also extensively used on trucks and passenger cars.

INTERNAL GEAR NEWS.

The Internal Gear Drive Association of Detroit has begun the publication of a booklet called the Internal Gear News, which will be circulated among engineers, motor truck executives and dealers in motor trucks. It will be issued at intervals of a few weeks and will cover matters that are outside of the range of trade and newspapers. Every truck and axle manufacturer in the Internal Gear Drive association is said to have doubled facilities since last spring and still further additions to many of the plants are under way.

JOY'S TRIBUTE TO PARDINGTON.

A. R. Pardington, vice president of the Lincoln Highway association and the man who has been chiefly responsible for the development of that movement, died recently in a Detroit hospital. He had been ill for many months previously. A fine tribute to his former associate has been paid by Henry B. Joy, president of the association, who has sent to the press a handsomely printed eulogy.

BUCKBEE IS MANAGER.

C. J. Bender, secretary and treasurer of the Ahlberg Bearing Company of Chicago, on a recent trip to the eastern branches of the company, appointed George A. Buckbee, manager of the Boston branch. Mr. Buckbee was formerly connected with the Fafnir Ball Bearing Company.

WAGENHALS IN CREDITORS' HANDS.

The Wagenhals Motor Company, maker of a three-wheeled commercial vehicle, is now in the hands of its creditors. According to the schedule the liabilities amount to $13,673.91. Assets are estimated as $15,000, mostly in tools, materials and patents.

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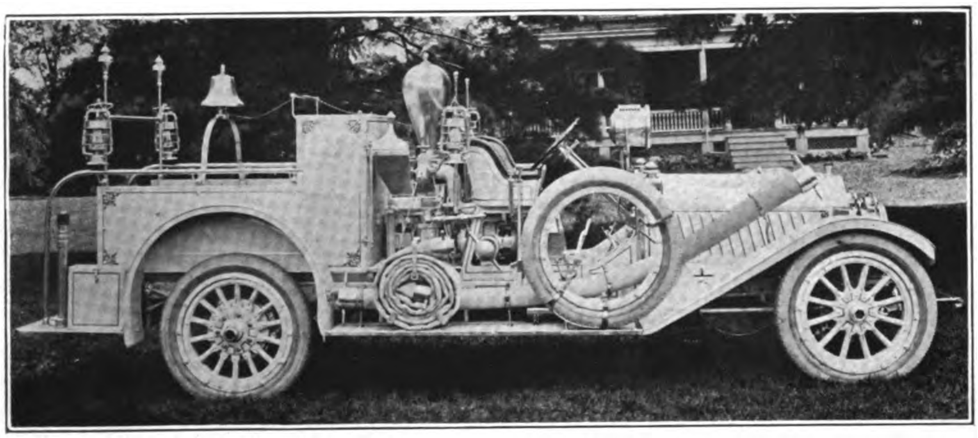
THE THOMAS AUTOMATIC CHEMICAL FIRE ENGINE.

A NEW chemical engine, standard in construction and equipment, which is said to have greater efficiency in extinguishing fires than any apparatus that has hitherto been built, is the production of the Thomas Automatic Fire Engine Company of Columbus, O.

It consists of a standard White chassis equipped with a Rumsey pumping engine and the Thomas automatic chemical charging apparatus. The chemical used is bicarbonate of soda (plain baking soda), which on being heated to 110 degrees or higher, liberates large volumes of carbonic acid gas.

This solution of soda and water, when sprayed on a fire, shuts off the supply of oxygen and quickly suppresses it. This use is very old in fire fighting and is the basis of practically all chemical extinguishing apparatus. The only difference is that in the new apparatus the fluid is projected by a pump instead of by the use of acid, and that the carbonated water is supplied in vastly greater quantities than has ever been possible before.



The Thomas Automatic Fire Pumping Engine, Equipped to Charge a Limited or Unlimited Quantity of Water with Chemical.

The apparatus consists of a not unusual type of gasoline pumping engine, driven by the truck motor, a bin in which the soda is stored, a conveyor by which the chemical is taken from the bin to a mixing chamber device which thoroughly impregnates every cubic inch of water with the soda in constant proportions, no matter how much or how little is used.

In the apparatus which is designed to be used on a 45 horsepower, four-cylinder White chassis, the capacity of the chemical bin is 1000 pounds, which is sufficient to charge 8000 gallons of water, and the capacity of the outfit on the six-cylinder, 60 horsepower White chassis is 1500 pounds of soda, which will make 12,000 gallons of solution.

When the soda has been exhausted the supply can be easily renewed from a tender if additional solution is needed, or the engine can be used to pump clear water.

The characteristics of the chassis on which this apparatus is mounted are as follows: Cylinders are cast en bloc with intake and exhaust manifolds and water passages integral. The aluminum crank case is cast in two parts. The crankshaft is mounted on one plain and two ball bearings. The tungsten inlet and exhaust valves are placed on the same side of the cylinders. The camshaft and cams are a one-piece forging. The timing gears are spiral cut. A high-tension magneto is used in a single ignition system. The standard White carburetor is employed. The water circulation is impelled by a gear driven centrifugal pump. The radiator is a honeycomb type, with belt driven fan for additional radiation.

A combination splash system with positive feed is used for lubrication, these being direct feed to each of the main bearings. The connecting rod bearings are lubricated by ducts drilled in the crankshaft.

Motor starting is facilitated by a compression release operated by foot from the driver's seat when the electric starter is in use, and by a small hand lever at the front of the frame when the motor is hand cranked. The single plate White clutch, running in oil, transmits power to the four-speed transmission gearset of the selective type. In changing it is not necessary to pass through the intermediate speeds.

The White system of electric starting and lighting with a single unit generator motor is used in these chassis. The drive is by shaft to the jackshaft, from which it goes through side chains to the rear wheels. Brake bands are mounted integral with the jackshaft sleeves.

The body is made of steel and riveted. It has sufficient capacity to hold 1000 feet of 2½-inch hose in the four-cylinder chassis equipment, and from 1200 to 1500 feet in the six-cylinder chassis. In addition to the chemical mixer for the stream of water that is pumped there is an ordinary chemical tank with acid receptacle for use at small fires or before the hose is attached to the hydrant and the regular pump is operating. The machines have all the usual fire equipment ordinarily provided for standard combination chemical wagons.

The New York City fire department has ordered 24 pieces of apparatus of the combination hose and chemical type mounted on Mack chassis. This order follows one for 12 Mack city service ladder trucks, bringing the total number of Mack machines in the New York fire department to 109.

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BENZOL TO BE PLENTIFUL.

An increase of the American production of benzol to a volume five times greater than it was before the war is predicted before the first of the year by D. W. Jayne, head of the chemical department of the Barrett Manufacturing Company. Makers of dyes who have been seeking supplies of benzol have been disappointed with the present output, but this is because the various steel plants whch are installing equipment to recover benzol at their coke ovens have not yet reached full production. Benzol can be used as a substitute for gasoline in internal combustion motors.

JOIN FOUR WHEEL DRIVE AUTO COMPANY.

Three new special representatives have been appointed by the Four Wheel Drive Auto Company of Clintonville, Wis. One is J. C. Turk, recently with the International Harvester Company in Philadelphia and New York, and formerly in charge of sales of the International Pump Company in South America and Cuba. He will have charge of the eastern territory, with headquarters in Milwaukee. H. C. Gooding will represent the company in the middle west, with headquarters in Chicago. He was recently in charge of the New York branch of the Corliss Carbon Company and was formerly manager of the Flanders Electric Company in Canada. F. H. Burdette, recently with the Standard Motor Sales Company in Pittsburg, and formerly district manager of the Nyberg Company on the Pacific Coast, has joined the sales forces and will eventually devote his time to the Pacific Coast, with headquarters in San Francisco.

NEW 1200-POUND DELIVERY WAGON.

The Bell Motor Car Company, York, Penn., is to produce a 1200-pound delivery wagon, using the same chassis now used for its passenger car. The machine will be sold for $775, with electric lights and electric starter. A lower price may be made for chassis which do not carry that equipment.

Because of its increased profits and through a desire to forestall strikes, the International Motor Company has raised the wages of the men in its Plainfield plants. For the past five months the company has been working night and day on military truck orders for shipment abroad. The Plainfield plant makes Saurer trucks chiefly.

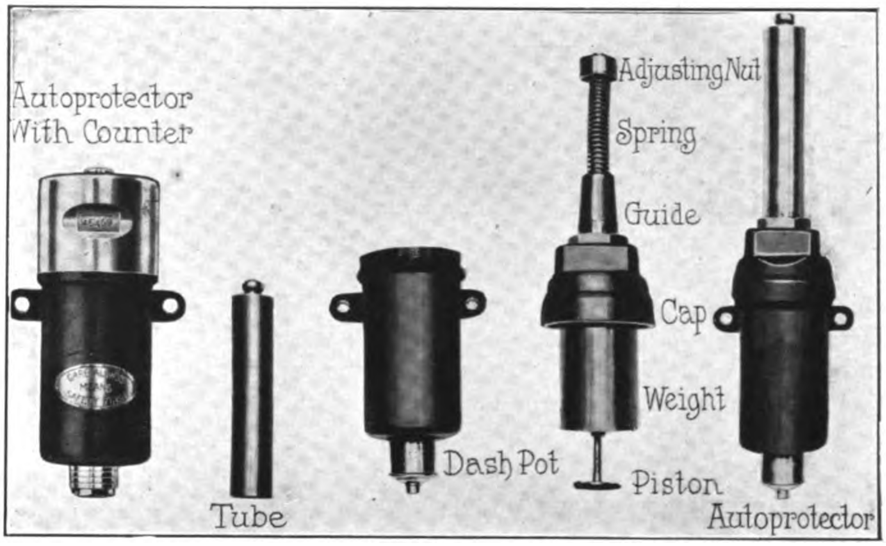
VEHICLE SHOCK RECORDER

Autoprotector a Device to Minimize Any Form of Truck Abuse.

The Autoprotector is a new automatic device for motor trucks or passenger cars which serves as a governor without many of the objectionable features of the constant engine speed or constant vehicle speed governors and at the same time records abuse of the vehicle for the benefit of the owner.

It differs from all other governors in that the principle of operation has no relation to the speed of the truck or car, but is based rather on the shocks which the mechanism sustains.

Thus it will permit almost any speed on a perfectly smooth surface where no injury is done to the vehicle mechanism, while it might shut off the power of the motor at eight miles per hour on an exceptionally rough road if the shocks were sufficiently severe.



The Autoprotector, a Device for Controlling Speeding and Recording Severe Road Stresses, Complete and Disassembled.

The device consists of a tube mounted on the front axle, where the most severe shocks that affect the car might be expected to be felt. Inside of the tube is a sensitive inertia weight balanced on a spring.

In ordinary vehicle movement this weight remains stationary in a normal position, but when the surface is rough it begins to bound up and down inside the tube. The spring may be adjusted so that this action can be secured by greater or less shocks on the axle, according to the desires of the owner.

An electric cable connects the device with the ignition system, so that under a certain degree of agitation the Autoprotector will open the ignition circuit, or it may be set to work a throttle in the gas line to gradually reduce the speed when driving on rough streets or roads.

At one end of the Autoprotector is a counter similar in appearance to the indicator of an odometer, but instead of registering the mileage or the number of

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turns made by a wheel, it records instead the number of times the weight rises and falls in the tube. In other words, it registers the number of shocks of sufficient severity to cause the weight to move.

Thus in addition to its functions as a speed governor, the autoprotector reports to the owner of the truck the degree of abuse to which the vehicle is subjected. It, of course, supplies the same information to the driver and is a constant reminder of the necessity of driving the vehicle with judgment and care.

It can be sealed so that adjustments cannot be made without breaking the seal and so serves as an effective check against reckless driving. It is declared by the makers to be a very effective protection against practises which run up the upkeep costs on motor vehicles and by enforcing careful use of the vehicle is a great saver of repair expense.

The device costs $18 without the counter and $25 with it.

S. A. E. COMMITTEE MEETINGS.

The interim meeting of the standards committee of the S. A. E. will be held in Chicago, Oct. 15. The miscellaneous division of the committee held a meeting in Detroit, July 16, at which standardization of license plates, chassis numbers, motor numbers, piston ring grooves, expressing car weight, air pump bases, water hose and hose clamps and speedometer drives were discussed. On July 30 a meeting was held at the Detroit offices of the committee, at which nomenclature was discussed. The first meeting of the year for the metropolitan section will be held in New York, Sept. 16, and the Indiana section will meet Sept. 24.

INDEX OF PIPE INFORMATION.

The National Tube Company, Pittsburg, Penn., which has issued from time to time bulletins describing various processes in pipe manufacture and installation, has now issued a large index bulletin, which tells any one interested in any subject connected with pipe how and where to get the information he is after. The bulletin consists of 30 closely printed pages of topics. It opens the door to a vast storehouse of information regarding tubular products which should be of value to any one who is interested in their use.

The Duplex-Power Car Company, Charlotte, Mich., is expected to increase its capital stock from $100,000 to $200,000 to build additions to its plant and keep up with its orders. There is belief that only about $25,000 worth of new stock will be sold in the open market.

E. S. Roberts, who was formerly with the Kelly-Springfield Tire Company of New York in its solid tire department, has recently become sales manager of the truck tire department of the McGraw Tire and Rubber Company, East Palestine, O.

IOWA GAINS IN REGISTRATIONS.

Iowa is making rapid gains in the number of motor vehicles registered and is approaching California, fourth among the automobile using states in the Union. Registrations in Iowa have passed the 130,000 mark, while in California on July 3 they totalled 137,-383.

Iowa is almost entirely an agricultural state, Des Moines, its largest city, having had a population of less than 90,000 in 1910. It is, therefore evident that a great majority of Iowa automobile owners are farmers. The Iowa registrations are expected to pass 150,000 by the end of the year. In view of the fact that New York, the greatest automobile market in the country, has only a little more than 200,000 registrations, will give an idea of the importance of the western farmer to the automobile producer. Iowa has a population of only a little more than 2,000,000, and that decreased slightly in the decade between 1900 and 1910. The value of the farm property in the state is $1682 per capita.

The high prices prevailing for food stuffs and farmers' produce, and the consequent prosperity of this section, is expected to greatly increase the purchases of cars and trucks suitable for agricultural work during the fall. The use of motor farm machinery is expected to largely increase from the farmers' motoring experience.

WORK ON FORD TRACTOR PLANT.

The first actual work to be done in laying out the new plants of the Ford Motor Company on the River Rouge, in Detroit, will be the making of a topographical map which is already under way. The dredging of the River Rouge so boats can ascend it will soon be begun. Whether the Ford company or the United States government will do this work is not as yet certain, but apparently the Ford plan contemplates that the company will do the dredging if the United States will not.

CONTRACTORS BUY MOTOR TRUCKS.

Recent large purchases of Autocars from the Autocar Company of Ardmore, Penn., have been made by contractors who are using the two-ton Autocar with power dumping body. One contractor, who is supplying 60,000 tons of crushed rock for boulevard construction, has a fleet of trucks, each of which is delivering 48 tons a day and is driven 153 miles. The delivery cost is 22½ cents a ton by truck as compared to $1 by horses.

The International Motor Company is said to have closed contracts for a number of worm drive Mack trucks to be sold in England by the Milnes-Daimler Company of London. The contract extends for two years.

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RESULTS OF FORD'S PROFIT PLAN.

How the Ford profit sharing plan has resulted for the men who have been benefited by it is shown in statistics recently issued by the sociological department of the company. The total amount of money deposited in banks by employees is $3,046,301, which is a gain of 205 per cent. over previous deposits. Life insurance totals reach $6,493,709, or a gain of 163 per cent. Homes owned show an increase of 99 per cent., and the value of homes bought on contract is now $8,867,159, an increase of 170 per cent. in a year. The amount in bank has gained $138 per man and the life insurance has gained $269 per man. For the year 9911 men enjoyed the benefits of the profit sharing plan.

JAPAN A POOR TRUCK MARKET.

The reasons why firms who represent motor truck manufacturers in Japan have made very little selling progress are explained in a letter from the representative of the B. F. Goodrich Company in Tokio to a truck manufacturer.

The trucks in service are used for post-office and mail delivery and as passenger conveyances between distant points, and a few are utilized by large firms for freight hauling. A truck of three tons capacity is unfitted for the market because short distances outside the cities all bridges are light bamboo and will not withstand the weight of such a machine. Labor is so cheap in Japan that most all delivery is by hand carts. A child of from eight to 16 years has the strength to pull a fully laden cart through streets for long distances. Boys doing such work receive no wages, but are allowed to sleep in the stores, are fed and are given two very cheap changes of clothing a year. Operating trucks to reduce the cost of delivery that practically costs nothing does not appeal to Japanese merchants.

RAVENNA TRUCK IS NOW MOHAWK.

The Ravenna Motor Truck Company, Ravenna, O., has been reincorporated as the Mohawk Truck Company with capital of $25,000. The new company will take over the plant and property of the former concern. Orders are on hand which will require operation 24 hours a day in the near future.

Service was the chief topic of discussion at the July meeting of the Motor Truck Club of New Jersey, held at the Automobile Club of Newark, Tuesday, July 20.

A three-story brick and concrete building is to be added to the plant of the Autocar Company, Ardmore, Penn.

HYATT OFFICE BUILDING

Increased Needs of Bearing Company to Be Met in Handsome Structure.

Although but several years since the automobile division of the Hyatt Roller Bearing Company moved to what at that time were commodious quarters in Woodward avenue, it has now become necessary to erect a larger building to meet the needs of the organization and a handsome new structure is under construction in West Grand boulevard in Detroit.

The structure is of dignified design. It is three stories, with an exterior of red brick, with stone trimmings and cornices. The main entrance is of stone, decorated with ornamental iron lamp standards. There will be stone flower boxes outside the second floor windows over the entrance.

Columns and floors are of reinforced concrete and the structure will be fireproof. A great reception hall will occupy a large space in the centre of the building on the first floor. The walls will be quarter sawed oak, with a richly decorated plaster ceiling. On this floor also will be located the service room, offices of the experimental engineers, mailing room and the garage and telephone exchange.

The New Office Building Now Being Completed for the Hyatt Roller Bearing Company at Its Detroit, Mich., Plant.

The second story will be reached by a main stairway and two secondary stair cases. The main stairway will be constructed of marble, with an ornamental iron balluster. General Sales Manager B. G. Kroether, Advertising Manager W. E. Biggers and Chief Engineer R. S. Lane will have their offices on this floor. There will also be a conference room and offices for clerks, stenographers, sales travellers and mechanical inspectors, and a woman's rest room and men's smoking room on this floor. The use to be made of the third floor is not yet determined. On the lot about the building tennis courts for the use of the employees are being constructed, with facilities that will make for the comfort of the players.

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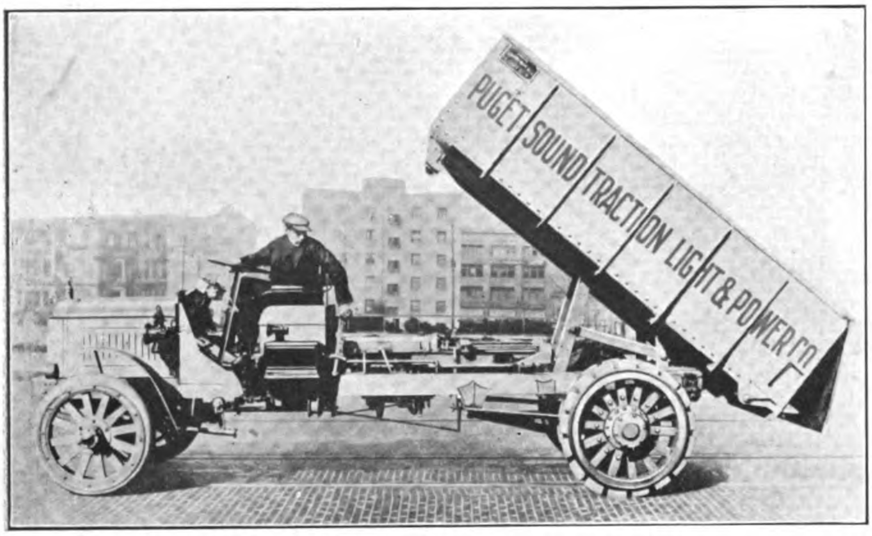
PROFIT IN SALES OF ASHES.

Public Service Company's Plan for Disposal of Waste.

There are now many power plants such as those of trolley lines central station lighting plants, and large manufacturing establishments where coal is used constantly in very large quantities and correspondingly large volumes of ashes and cinders are taken from the furnaces of the power plants.

These waste products have a distinct value to contractors, and builders, being used for foundations under concrete, for fills, and in many cases for surfacing paths and roads, and are bought in varying quantities. In the past, with horse transportation, the companies often found it impossible or too expensive to deliver the material where it could be used and good prices obtained.

But with large capacity motor trucks mechanically loaded and unloaded, this haulage expense can be greatly cut down. In many cases it has been found that the waste can be sold for a price, based on the amount of material and the distance which it is hauled, sufficient to pay all expenses of its disposal and so relieve the company of an expense that often reaches considerable proportions.



A Four-Ton Worm Driven Packard Truck, Used by the Puget Sound Traction, Light and Power Company, Seattle, Wash., for Hauling Ashes.

The Puget Sound Traction Light and Power Company, Seattle, Wash., is a public service corporation that has worked out an extremely efficient system of handling its whole coal, ash and cinder problem. Coal is dumped at its power plant from hopper bottom cars at the street level and mechanically elevated and fed to the boilers. Cinders fall into hoppers below and are carried in dump cars to the truck loading platform. From the time the coal arrives in railroad cars until the ashes are taken away it is unnecessary to use a shovel upon it.

From the loading platform the truck carries the load to its destination at some building job. The price received for the material has been found to be more than enough to pay interest on the truck investment.

Few plants of this type are so situated that it is possible to permit any large accumulation of ashes and removal necessitates sufficient equipment to keep the ash bins free. But with the constantly increasing use for ashes and cinders, and with prices sufficient to justify systematic disposal of them, any factory, works or mill can install facilities for handling and hauling them as a business investment that is sound and economical. Instead of paying to have the ashes carted away, the concern can get prices that will pay for this work, and probably be profitable. Besides, the truck would be available for any other haulage that may be necessary.

FIGHT TRUCK FENDERS IN CHICAGO.

Chicago users of motor trucks, dealers and manufacturers have submitted arguments to Chief Healy of the police department against the forced adoption of truck fenders which were tried out recently and reported favorably to the chief by three men representing the city.

Among those opposing fenders are Armour & Co., the Consumers Company, Chicago Telephone Company, members of the Chicago Association of Commerce and the Chicago Automobile Trade Association. Makers of six different kinds of fenders were present, and they formed an association to protect their interests which is called the Fender Manufacturers' Association.

Russell Huff, consulting engineer of the Packard Motor Car Company, sent a communication in which he said that 90 per cent. of the accidents in which wheels pass over the body of a person are caused by the rear wheels, against which front fenders would be no protection.

DENBY PURCHASES DETROITER PLANT.

Following the sale of the personal property of the Briggs-Detroiter Company at Detroit to A. O. Dunk of the Puritan Machine Company, the real estate and buildings have been sold to the Denby Motor Truck Company for $63,500, which is the exact amount at which the property was appraised by the trustee.

The volunteer fire department of Lansdale, a suburb of Philadelphia, Penn., has recently purchased and installed a $5000 triple combination motor pump. Money was raised by the town's chamber of commerce and by bazaars and fairs organized by the firemen.

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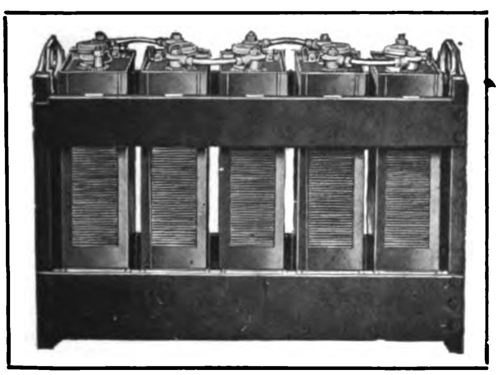
ELECTRIC VEHICLE PRACTISE.

The Methods of Constructing the Edison Nickel-Iron-Alkaline Cells and Description of the Special Processes Necessary for the Production of the Positive and Negative Plates and the Assembly of the Components.

(By William W. Scott.)

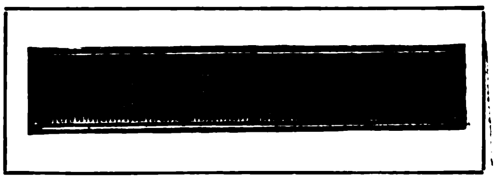
EDISON secondary battery cells have an entirely different aspect to the chemist, electrician or battery engineer than the lead-acid cells, because when an Edison cell has been formed and is in service it is not subject to chemical or electrolytic changes, and aside from mechanical causes for failure which cannot be attributed to design, material, construction or workmanship, one may assume that it does not require attention other than charging and "flushing or equalizing" when the electrolyte becomes low. There are no chemical conditions or changes resultant from the action of the electrolyte upon the electrodes, and the value of the one series of electrodes with reference to the other is not affected by the continued use.

By this is meant that so far as is known the efficiency of the plates is diminished in like ratio after long periods of service, probably because of the accumulation of what may be described generally as "dirt," which may obstruct some of the tiny perforations in the steel jackets of the active material receptacles on the plate grids. The plates cannot diminish in area and they always maintain the same degree of permeability by the electrolyte, and as activity of the material cannot be affected by the electrolyte, there appears to be no good reason for the deterioration of the cells unless such obstruction as has been stated results from impurities deposited in them through failure to observe the essentials for insuring the purity of the distilled water frequently needed to replenish the volume of electrolyte.



A Five-Cell Battery of A5 Edison Cells in the Crate Ready for Connection.

The electrolyte of the Edison cell will not afford knowledge of the condition of the charge if the hydrometer readings are taken. It must necessarily have a stated specific gravity, due to the addition of the potassium hydrate to the distilled water, but this does not vary with reference to the charging or discharging of the cell, and voltage readings can only be obtained through the voltmeter. The electrodes have always the same ratio of potential—that is, there can be no difference in them, one plate having greater or less activity than another or others, a condition resultant from chemical action in other types.

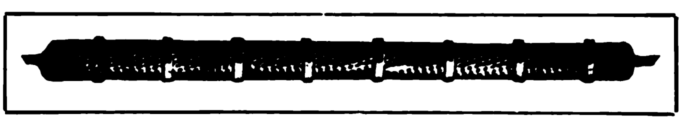


A Pocket of the Negative Plate Loaded with Iron Oxide, Prepared for Placing in the Plate Frame.

The Edison cell differs from all other secondary cells in that it is not accessible in the sense of disassembling for reconstruction. When assembled the top of the container or can is welded to the sides and it cannot be removed, and the examination and testing necessary or desirable with other types cannot be made. The only opening is the filler, which is covered with a clamped cap, and this is merely to add water and from time to time renew the electrolyte.

The construction of the Edison cell is entirely different than those of the lead-acid type. The plates materially differ from each other and they can be identified at a glance. But as the battery man has no occasion for disassembling the cells, there is no need for even identification. The metal parts of the cell, aside from the active material, is constructed of steel, which is heavily coated with pure nickel. This means that all parts of the cell in contact with the electrolyte are really nickel-coated, and the steel of which the container is made is not influenced by the solution.

The cells are made in 12 standard sizes, which are differentiated by letters and figures, the letters designating the size of the plate and the numerals the number of positive plates to a cell. There is always one more negative plate than positive plate, and for this reason an A12 cell would mean that it was composed of 12 positive and 13 negative plates, or 25 in all. The cells are two types, that defined as A for motor vehicle and other uses where large capacity is essential, and that defined as B for lighting, starting and ignition batteries, and such purposes where minimum weight and small space required are prime essentials and of more importance than length of serviceability



A Tube of the Positive Plate Filled with Nickel Hydrate and Ready for Assembly in the Grid.

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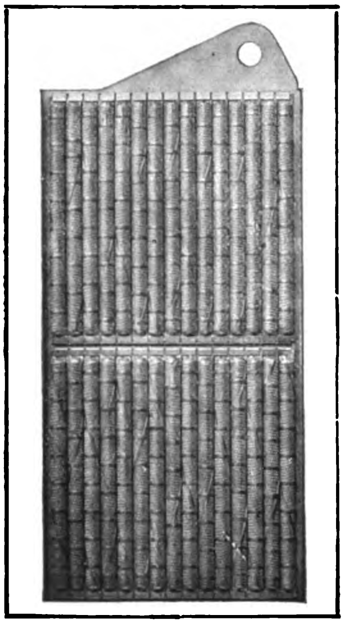
between charges. The data of cell sizes and capacities shown in the accompanying table are interesting.

The construction of the Edison cell is to a standard design for each of the two types built, the A and the B, and in each of these the capacity is obtained by the increase of the number of plates used, each type plate being uniform in the cells of that type. The plates are constructed with a steel grid or frame, that of the positive plate carrying a series of tubes and that of the negative plate carrying a series of rectangular pockets in which are placed the active material.



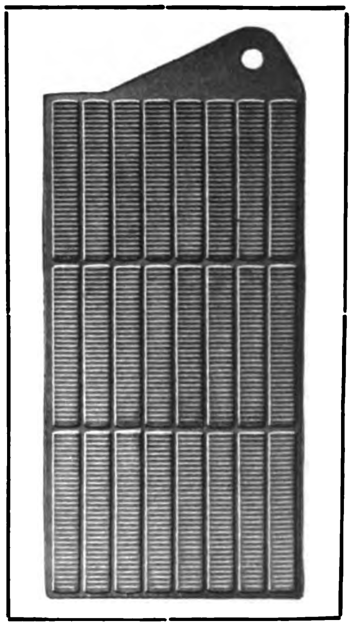
The Positive Plate of a Type A Cell, Which Has Two Rows of 15 Tubes Each.

The grids are steel stampings from stock of a standard gauge, and these are heavily coated with nickel. The stock from which the tubes of the positive plate are made is a thin gauge steel tape or ribbon. This is taken in reels and passed through a machine that has a set of roller dies which perforate the central section of the ribbon. This leaves an unperforated edge at either side. The ribbon is next sent through a second machine that twists it into a tube with the unperforated edges formed to make a spiral double lap. The lap makes a full spiral about the tube, each 2½ inches of length. At the lap there is four thicknesses of metal, very firmly consolidated, which very much strengthens the tube. The perforated section of the ribbon is .75-inch width and in this there are 20 perforations across, and there are 16 to the running inch. This gives something like 325 perforations to the running inch of the tube. This tube is cut into 4.625 inches lengths. The forming of the tube insures great rigidity when it is filled, although the metal is so thin and ductile after the lap has been made that it will yield readily under ordinary finger pressure. The tube is .25-inch internal diameter.

The pockets for the active material of the negative plates are made of a thinner gauge steel than the positive tube, and this is approximately an inch width. The ribbon is passed through a series of roller dies that make three rows of perforations, that in the centre being about .5-inch width, and those at each side about .09375-inch width, with unperforated sections at the edges and between approximately .03125-inch width. The perforations are approximately 32 to the inch longitudinally and 25 to the half inch width, this giving about 800 perforations to the running inch of length. The rows of perforations on the sides are of the same size, there being about 200 to the running inch.

The ribbon, after perforation, is sent through a machine that bends the edges at right angles to the centre section along the unperforated lines, so that it is a shallow channel section .5-inch width, with webs about .15625-inch width. This is cut with the webs approximately three inches and the main section about 3.25 inches length, so that when the ends of the main section are turned the ribbon is formed into sections that are fitted the one within the other. In the forming one end of the section and the webs are turned so that when the pieces of metal are telescoped together one end is open.

The steel of which the cell container or can is shaped on forms with a lap at one corner to form the sides, and the bottom sections are cut to exact size. The side lap of the can and the bottom section are welded by autogenous process. The sides of the can are corrugated to give mechanical strength and radiating surface. The top of the can is also a steel stamping, into which is welded the filler and the collars or seats through which the terminals of the electrodes project.



The Negative Plate of a Type A Cell, Which Has Three Rows of Eight Pockets.

All of the metal, aside from the active material forming the cell, are heavily nickel plated, and after plating these are placed in retorts, which are hermetically sealed and fed with hydrogen gas. The retorts are placed in a furnace and heated to a temperature that causes the nickel to fuse and penetrate the pores of the steel, this insuring an impervious preserving coating for all parts in the exterior of the cell and positive electrical contact.

Type	B1H	B2	B4	B6	A3	A4	A5	A6	A8	A8H	A10	A12
Normal ampere-hours output..........	18.75	37.5	75	112.5	112.5	150	187.5	225	300	300	375	450
Ampere discharge, rate (eight hours).	2.25	4.75	9.5	14.0	14.0	18.5	23.5	28.0	37.5	37.5	47.0	56.5
Ampere discharge, rate (five hours)....	3.75	7.5	15	22.5	22.5	30	37.5	45	60	60	75	90
Average discharge voltage (eight hours)	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Average discharge voltage (five hours)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Normal discharge rate (seven hours)..	3.75	7.5	15	22.5	22.5	30	37.5	45	60	60	75	90
Weight of cell, complete, lbs..........	4.9	4.7	7.5	10.8	11.1	13.9	16.7	19.4	27.2	30.7	33.3	41.3
Weight per cell, assembled, lbs........	5.7	5.4	8.3	11.7	12.4	15.3	18.1	20.9	29.5	33.2	36.2	44.8
Amount renewal solution, per cell, lb..	2.0	1.0	1.7	2.5	2.3	2.9	3.6	4.3	5.8	8.7	8.2	9.7

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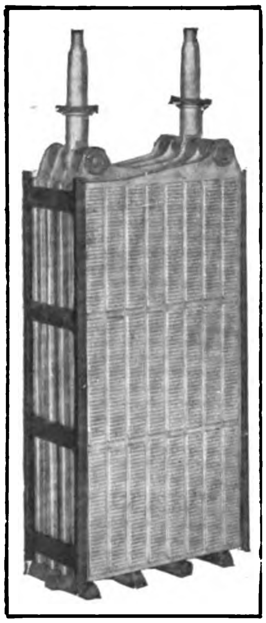
The tubes of the positive plates and the pockets of the negative plates are loaded mechanically, this being a much more certain method than were this done by hand and the work is accurate from every point of view. The nickel hydrate for the positive plates is in the form of a green powder, and the iron oxide for the negative plates is very finely granulated, resembling black loam in appearance. Both of these materials are specially produced at the chemical plant controlled by the Edison companies and have qualities that are desirable to obtain electrical efficiency.



The Assembled Element of an A4 Cell Withdrawn from the Nickelled Steel Can.

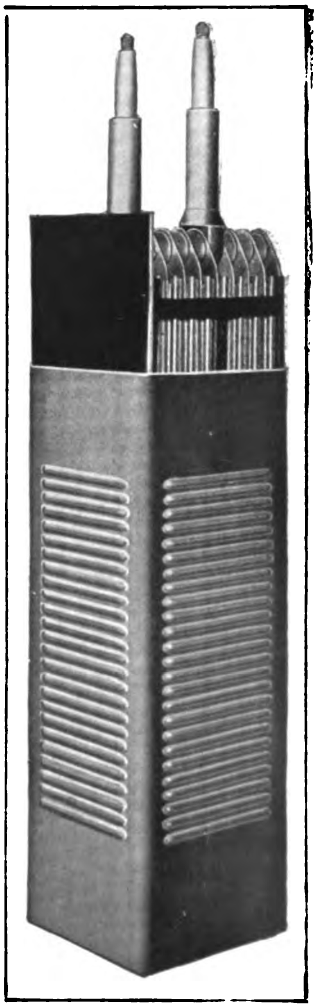
Another element entering into the positive plate tubes is flake nickel, which is used because the nickel hydrate has low conductivity, and to insure satisfactory activity of the plates higher conductivity is necessary. This nickel flake is produced by a process that insures its quality and uniformity of size. The nickel plating department is very large and in it are four travelling cranes that are operated by men who are carried by them. Each crane carries 10 large meal cylinders. Located beneath the railway of the crane at either end are 10 earthenware vats or crocks. Between the crocks is what resembles a washstand. The crocks at one end are equipped for copper plating and at the other end for nickel plating.

At regular intervals the carriage of the crane moves from one end of the railway to the other. The metal cylinders are lowered into the plating tanks and remain for a precise period, 20 seconds for one solution and 67 seconds for the other. Each immersion is accurately timed. Between immersions, while moving from one series of tanks to the other over the washstand, the cylinders are sprayed with water, that removes any solution and insures perfectly uniform plating. This alternation of plating is continued until 250 separate coats of metal, about .015625-inch thickness, have been deposited on the cylinders, each of which is about 1/25,000-inch thick.

The metal on the cylinders is pure. It is removed by cutting it longitudinally and separating it from the depositing cylinders. These sheets are then cut into pieces about .125-inch square, which are placed in solution in vats that dissolves the copper and leaves the nickel in square flakes. The nickel flakes are then washed and dried and are ready for use. No other process ever attempted would produce nickel uniform in quality and thickness, which is absolutely necessary for Edison cell efficiency.

The tubes are filled in a manner that insures the most accurate distribution of the nickel flakes through the nickel hydrate. First, this tube is, with a series of others, placed in what may be termed a loading machine. There is a separable steel block that has a series of vertical holes in it the external diameter of the tubes, and of a depth to take the full length of the tube, divided along the line of the holes. Directly over the holes in the block are a series of small tubes, through which steel plungers rise and fall. These tubes are also the outlets of small hoppers that are on either side of the block, one series containing nickel hydrate and the other nickel flake.

The series of tubes to be filled are first placed in the holes in the block with the closed end down. Into each is dropped a small steel disc that is forced nearly to the bottom by the first movement of the plunger. Then as the plungers rise and fall the outlets for the hoppers containing the nickel hydrate and the flake nickel are opened alternately, an exact quantity of each material dropping into the tubes. The filling is continued automatically, approximately 700 layers, 350 of each, are forced into the tube at a pressure of about 2000 pounds to the square inch, insuring very intimate contact of the flake nickel with the nickel hydrate and the sides of the steel tube. The filled portion of the tube will measure approximately 4.25 inches length. When the filling is completed a second steel disc is forced into the tube, and then the ends of the tube are closed by flattening them under pressure. The tubes are then sent through another machine that forces eight steel rings over each, spacing them equally along its length. The purpose of the rings is to resist expansion of the nickel hydrate when permeated by water.



The Positive and Negative Plate Assembly of an A8 Cell Partly Withdrawn from the Container.

The pockets of the negative plate are formed by taking two sections of the perforated metal and placing the open end upward in a series of holes in a separable steel block, similar to those in which the positive tubes are filled. The machine has but one series of hoppers, however, and as the steel plungers rise and fall the iron oxide, mixed with a small proportion of mercury to promote conductivity, is solidly tamped into the pockets. When the pockets are filled the

metal of the top and bottom is lapped to close them. When ready for assembling they are three inches length, .5-inch width and have a maximum thickness of slightly more than .125-inch.

The grids or frames in which the pockets and tubes are mounted are designed specially for each type of plate. That for the positive plate carries two rows of 15 tubes each, placed side by side, and has side, top and bottom members and a cross member. At the upper right corner, if held with the longest side in the right hand, is a lug that is formed by an increasing width of metal from left to right, in which is a hole for the arms of the cell terminal or pole. The inner edges of the top and bottom members and both edges of the cross member are slit horizontally and then folded in such a way as to make individual clamping jaws for the end flange of each tube. Assembling the positive plate is by inserting the tubes in the clamping jaws, and then the plate is subjected to heavy pressure in a press that so contacts the grid and tubes that electrical conductivity is certain.

The general form of the grid of the negative plate is with two cross members that divide the area into three sections, each section having a row or series of seven longitudinal members. Into these spaces in the plate are placed 24 of the loaded pockets. The plate is next placed in a press and subjected to 160 tons pressure, this corrugating the tops and bottoms of the pockets (which have now become the sides), and forcing the edges solidly against the frame, so that there is certain electrical contact. The corrugation of the metal of the pockets affords such a degree of elasticity that it is always tightly pressed against the iron oxide filling.

In assembling the cell the plates are mounted on cell poles that consist of T shape fittings. The single arm is the upright terminal or pole, and the double arm carries the plates. The positive series has always one less plate than the negative series. The plates are held on the rods by the holes of the lugs at the upper ends. They are spaced equally by steel washers and are retained by nuts, which are nickel plated. The plates are assembled in separate series and when these are made ready for the assembling of the cell the two series are placed together with the positive plates between the negative, separation being insured by hard rubber rods placed longitudinally, that are effectually retained between the plates by anchorage in the grooves between the tubes.

At the edges of the plates are placed hard rubber fittings that are ladder-like in form, having side and four cross members. In these cross members are narrow grooves, into which are fitted the edges of the plates. In assembling the cell a hard rubber grid is placed in the bottom of the can and two sheets of hard rubber are placed between the sides of the can and the negative plates. In this condition it is sent to the welding department, where the top is welded in by autogenous process, two hard rubber washers being placed on the vertical poles.

The cell is then ready for the external fittings, which consist of soft rubber washers for the pole pieces, and means for expanding these washers to form a gas and liquid tight joint between the top of the can and the poles. The packing washer is held down by a hard rubber bushing that is threaded into a pocket in the cell cover. The hard rubber bushing of the positive pole is red in color, and that of the negative pole is black. On the cell cover between the pole terminals is the combination filler and gas vent, which includes a seat and a hemispherical valve, and a top actuated by a spring to remain closed or fully open as desired. The valve is designed so that as gas pressure develops in the cell it will lift the valve and the gas will escape under the cap. After the cell is assembled it is coated with a compound that is flexible and insulating.

Every part of the metal in the cell is heavily nickel plated, the nickel being fused with the metal, and the bottom of the can is plated for the second time after welding. The tops of the terminal poles are tapered and the lugs for the terminal connections are steel drop forgings that are bored, reamed and ground to exactly fit the tops of the poles. The lugs are connected in pairs by curved copper rods swaged into them, these rods being of different lengths to meet the requirements of the cells. The finished connectors are given heavy platings of nickel.

The H type of cell designates those with longer containers, in which a greater volume of electrolyte is placed so that these, if installed in places not easily accessible, will require attention only at long intervals of time.

(To Be Continued.)

NO MOTORCYCLES IN RURAL DELIVERY.

The use of bicycles and motorcycles in rural delivery has been forbidden by the Postoffice Department on the ground that such vehicles have not sufficient carrying capacity for the parcel post service. Another reason given is that carriers using such vehicles are specially liable to injury, and as the department has undertaken to pay the salaries of injured carriers while they are disabled, it wishes them to avoid accidents. Automobiles may be used on the route if the carrier desires, even though the route has not been designated as a regular automobile route. Schedules must be submitted to the department for approval if the automobile is used. Cars can be used only on routes where road conditions assure regular and uninterrupted service.

The Mountain Trailer Company, Spokane, Wash., was recently organized by J. O. Mountain of the Diamond Carriage Company, A. H. Herta of the Signal Motor Truck Company and M. D. Hawkins of the Hawkins Motor Car Company, to construct a plant in Spokane for the manufacture of a patented motor vehicle trailer.

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GROSSMAN COMPANY MEETS ITS NOTES.

In effecting a time composition with its creditors on a basis of a payment of 100 cents on the dollar, the Emil Grossman Manufacturing Company issued extension notes due July 1. These were promptly met June 25. The company has enjoyed an unusually successful year, the gross volume of business running 55 per cent. ahead of that for any previous year. Plans are now under way for increasing the output of Red Head Spark Plugs, Everlastingly Good Bumpers and Everlastingly Good Motor Necessities of all kinds. The company believes that its financial difficulties have been entirely overcome.

TRAILER FOR PASSENGER CARS.

For paper hangers, carpenters and other workmen who carry their tools or materials in a trailer hauled behind a passenger car, the Lion Buggy Company of Cincinnati, O., is building a new trailer. It has been designed especially for use with Ford cars, but is equally satisfactory when used with any car that has not a gasoline tank at the rear axle. A special coupling is applied permanently to the rear axle, and to this the tongue of the trailer is attached by a king bolt. The trailer has a tread of 56 inches, so that it will track perfectly with the car. The wheels are 34 inches in diameter and have 1¼-inch solid tires. There is no lost motion between the coupler and the trailer, so there is no jerking when the car starts or stops. The body, which may be adjusted to a horizontal position regardless of the height of the axle of the towing car, is 42 inches wide and 72 inches long. It has eight-inch flare boards, with heavy hard wood sills, specially braced and ironed. The body is mounted on semi-elliptic springs. The trailer complete weighs 375 pounds.

PACKARD TAKES OVER FULLER BUILDING.

The Packard Motor Car Company has taken over the big service station erected in Boston by Alvan T. Fuller, for many years its New England dealer, said to be the largest in America, and the business will, in the future, be conducted as a branch. The price paid is said to have been close to $280,000. The establishment is one of the finest in the country. It was first opened in December, 1909.

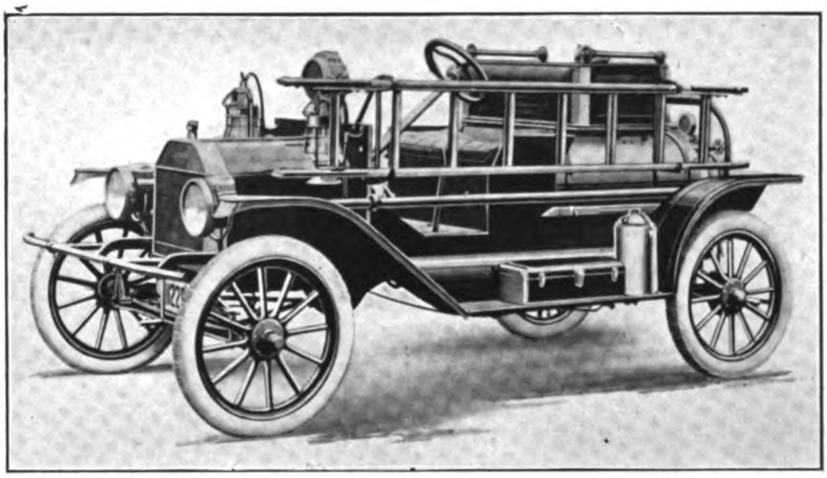
Shipments have begun on a new commercial car sold by the Willys Overland Company for $725 with an open body, and for $750 with a panel body. The car has 33 by four-inch pneumatic tires and the chassis is identical with that of the passenger car which is sold for $750 with a touring body.

FORD FIRST AID APPARATUS.

Well Designed Equipment for Suburban and Country Fire Service.

Designed to provide fire protection in many places that are now unprotected and to serve many uses where departments are already organized, the Ford First Aid Chemical apparatus has been placed on the market by the Hallock Engineering Company of Cleveland, O.

The various uses that can be made of this apparatus are described by its makers as follows: Chief's car in large cities, first aid apparatus in large city fire departments, to afford protection for outlying districts of large cities, as fire protection in small towns and villages where insurance rates are high because of lack of protection, for use in big manufacturing plants where efficient and quick fire apparatus is necessary, for big estates where many valuable buildings are constantly exposed to fire perils.



The "First Aid" Apparatus, a Ford Chassis with Fire Department Equipment, Produced by Hallock Engineering Company, Cleveland, O.

The price of the apparatus is $1400. This includes a standard Ford chassis complete with a muffler cut-out, rebound check springs, brass bar bumper and fitted with over-sized, non-skid tires front and rear.

The body is a special design with an upholstered driver's seat wide enough for two men and a step at the rear on which one man can ride. It is fitted with all necessary brackets and fastenings for chemical apparatus, ladders, lighting equipment, wheels and hood. The body is painted fire department red.

Complete tool equipment is furnished for the car and apparatus. There is a metal tool box mounted on the running board and additional tool capacity is afforded by a receptacle under the driver's seat.

The car is fitted with a 12-inch brass rotary fire gong operated by a pedal which extends through the floor boards in the driver's compartment. Electric headlights and electric tail light are included. On the dash is mounted a nine-inch gas searchlight, adjustable to any position and supplied with fuel by a 30-hour capacity gas tank.

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The fire fighting equipment includes a 35-gallon polished copper chemical tank with acid receptacle, agitator, washout spud, overflow valve and pipe, with a ¾-inch polished brass single by-pass, including pressure gauge, controlling valves, water hose connections and other fittings. This is connected to 200 feet of ¾-inch four-ply red rubber chemical hose in 50-foot sections, with expansion ring chemical hose couplings. This is carried in a hose basket with polished brass end rollers and corners.

Two three-gallon polished copper hand chemical extinguishers with holders and mounting brackets are supplied. There is also a 16-foot "steelback" extension ladder in nine-foot lengths painted and varnished and slung in brackets.

Other items of equipment are an extra acid receptacle for the 35-gallon tank, an extra soda cannister to hold a charge for the 35-gallon tank, a canvas soda bag, an eight-foot pike pole or fire hook with mountings, a six-pound fire axe with mountings, an eight-pound crow bar with mountings, and two Dietz Fire King oil lanterns, enamelled red, with copper founts, that are carried on lantern brackets.

MOTORS FOR FIRE DEPARTMENTS.

Progress toward complete motorization of both the New York and Philadelphia fire departments is being made rapidly. Philadelphia has an order for apparatus worth $100,000 which is soon to be delivered, and appropriations for $100,000 for similar equipment are now available.

In New York 20 automobile runabouts have been ordered for battalion chiefs at a cost of $423 each. In the past two horses have been kept for each battalion chief's rig and the cost of upkeep for a year has been around $300. The runabouts can be operated for $200 a year.

In December, 1914, there were 1167 horses in the New York department, where a year previous there had been 1341. They are now being replaced at the rate of about 200 a month. If funds continue to be furnished complete motorization will be effected in 1917. Last year the department spent $380 000 for motor equipment.

The department figures that each purchase of a motor hose wagon or other apparatus of that kind saves $280 a year in upkeep expense.

LOW COST FOR ELECTRIC SERVICE.

The Postal Transfer Company, which has carried mail between stations in New York on gasoline and electric trucks for several years, is the successful bidder for a similar contract in Boston. It is said to have submitted the lowest figure because it planned to use electric trucks.

These will be operated with the new battery service system of the General Vehicle Company. In a station on Atlantic avenue the Boston Edison company will store the vehicles and charge the batteries. As the batteries are interchangeable, those not in use are charged while the trucks are out and when necessary a battery can be changed in a very brief period. Current is supplied in the batteries as required and it is billed according to a mileage scale from the record shown by the hub odometer, and not on a basis of electrical units.

DEALERS DEFINE SERVICE.

The intention of many dealers to get down to a sound basis on the service question has become increasingly evident of late. Recently the Wentworth-Fosdick company of Boston caused the following to be published in a Boston newspaper:

"The Wentworth-Fosdick company has never made any representations or pretense of giving something for nothing. Our policy has been literally to sell service.

"Our idea of service has been to be ready and willing to serve customers in a business like way, but always to have the customers to understand they are to pay for the service which we render. The question of the manufacturers' guarantee is quite another question, which very frequently is the cause of misunderstanding."

NEW GOODYEAR DEMOUNTABLE RIM.

Following the policy of motor car manufacturers to reduce car weight and simplify mechanism, the Goodyear Tire and Rubber Company is making a new type of quick detachable, demountable rim. The side rim and locking flange are combined and can be snapped from the rim in an instant so the tire can be taken off. After the tire is replaced the side flange slips into place without effort. Similar simplification has been effected with the detachable, demountable rim, so that the tire cannot only be taken off quickly and easily, but the rim can be removed from the wheel in the same way. The rim bases of both types are solid, weather proof and water proof, eliminating the split that punctures tubes and destroys trueness.

The Universal Truck Company of Detroit has resumed the manufacture of its models, which are 1½, two and three-ton trucks. Charles P. Derr is president of the company, which occupies a new plant at Stanton and Grand River avenues.

The Kalamazoo Motor Vehicle Company, Kalamazoo, Mich., has changed its name to the Columbia Truck and Trailer Company. It has enlarged its activities to include the manufacture of trailers.

Eighteen months of preliminary work and testing of the new 1½-ton truck of the J. C. Wilson Company of Detroit, Mich., will be ended in October, when shipments in quantity will be begun.

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KNOX TRACTOR BEST IN FRENCH ARMY TEST.

American Machine Shows Three Times the Haulage Capacity in Towing and Climbs Hard Grades with Big Loads, Having Remarkable Traction and Power.

REMARKABLE results, which are claimed to be unequalled by any vehicle ever tested by the French minister of war's department, were recently obtained with one of the new four-wheeled Knox tractors. The tractor was tried in four separate ways.

One was a hauling test up an eight per cent. grade with varying loads. One was to haul 14 tons from Le Havre to Paris, a distance of 137 miles. There were tests on gradients of 12, 16 and 19.7 per cent., and tests on cobblestones and in thick mud.

In the first test the tractor, weighing unloaded 9185 pounds, was used simply for towing without one of the semi-trailers attached by one end to the platform. The route was up a steep grade of from six to eight per cent. on a well known hill leading to La Havre. A trunk of tools and spare parts and a box of stones and iron weights were carried on the platform to assure traction. The weight of this load was 3806 pounds.

Six trials were then made, using the tractor to haul different numbers of Pierce-Arrow trucks over the hill, the trucks being coupled by wire cable sections about 20 feet long. Each truck weighed about five American tons and carried a load of two smaller trucks boxed, weighing approximately one ton each, or a load of over eight tons for each truck.

The tractor made the ascent first with three trucks, totalling more than 26 tons, in two minutes and a half, and repeated the performance with the same load in substantially the same time. Then two more trips were made with four trucks and a load close to 35 tons and the truck made the ascent in two minutes and 50 seconds. The last ascent was made with five trucks, totalling nearly 43 tons, and the time was three minutes and 40 seconds. On the last trip up the tractor was stopped dead in the middle of the grade, but was readily started and continued up the hill.

Similar tests have been made on the same hill by French army officials with other makes of lorries and the nearest performance to this was one which got up the hill with 15 tons—slightly more than one-third the weight taken up by the Knox tractor. Only in one trip up the hill was there any loss of traction on the driving wheels of the tractor. This was slight and could have been overcome by adding a little more weight to the load on the tractor platform.

In the 137-mile test from Havre to Paris the tractor was used with a semi-trailer. The body that carried the load had one end resting on the tractor platform and the other on two wheels attached near the rear. Behind this semi-trailer an additional four-wheel trailer was drawn.

The combined weight on the tractor rear axle and the semi-trailer rear axle, according to the official scales, was 17,808 pounds, while the weight of the second trailer was 13,190—a total load of approximately 15½ tons.

The official running time for the 137 miles was 16 hours and 50 minutes, which would give an average of approximately eight miles an hour. The route included many very long and very steep hills. Forty-nine gallons of gasoline were used, an average of 2.8 miles to the gallon, or 38.4 miles per ton per gallon. The total oil consumption was given as two quarts. No water whatever was placed in the radiator during the trip and at no time was the engine hot.

First Knox Four-Wheeled Tractor in New York City Demonstration—The Second Machine Built Was the Subject of the French Army Tests.

A Quick Repair Made.

The entire trip was made without involuntary stops, without adjustments and without fault, except that at one time a rocker bracket arm broke, but a new one was installed in 35 minutes. This is proof of accessibility. This machine was the second one of the new type four-wheeled tractors turned out by the Knox Motors company and in assembling it hurriedly a rocker arm from the old model was used instead of one of the new and heavier type arms designed for and which will be used on all standard tractors.

The next test for this machine was on a very steep hill with three distinct grades, one of 12 per cent., one

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of 16 per cent. and one of 18.7 per cent. The surface of the road was covered with loose pebbles and gravel. The conditions and load were the same as on the trip from Havre to Paris, the tractor carrying a semi-trailer and hauling behind it a four-wheeled trailer. With a total load of over 15 American tons the tractor readily climbed the 12 per cent. grade. On the 16 per cent. grade the tractor failed half way up the grade because of loss of traction of the driving wheels, this being due in part to insufficient load on the driving axle and in part to the loose gravel surface of the road. A third test was made with the four-wheeled trailer detached and the whole grade was climbed rapidly, including the 19.7 per cent. grade, with a load of more than eight American tons. A test was then made on another grade ranging from 12 per cent. to 13.2 per cent., with the four-wheeled trailer attached and the tractor went up rapidly with a load of more than 14 American tons.

Springs Tested on Cobblestones.

On another occasion with a load approximating 14 tons the tractor was tried over a very rough cobblestone pavement to test its springing, and came through without demerits. Then a 15 per cent. grade of considerable length, with a very rough cobblestone surface, was climbed on low gear to test the radiation system, and the engine was found to be cool at the top of the ascent.

Another test made was through woods where there were many spots of thick, soft mud. The first test was made without driving chains and in the mud the tractor stalled. Heavy non-skid chains were then attached to each driving wheel and the entire load was pulled through without any loss of traction.

This was the first official test of the new Knox tractor either in America or Europe, and the results are without precedent and entirely exceed expectations. A considerable number of the tractors are said to have been bought by the French government, and in view of their tonnage capacity a very large general market for them is regarded as certain.

WARREN TRUCK OFFICERS CHOSEN.

R. B. Wick has been elected president of the Warren Motor Truck Company of Warren, O. C. B. Loveless is vice president, L. L. Jones secretary, and G. D. Braden treasurer. D. M. Bell is general manager. All of the equipment of the Standard Motor Truck Company has been purchased and the same plant will be used for the manufacture of trucks.

DAY BAKER HEADS G. V. SALES.

Day Baker, who has for several years been in charge of the General Vehicle Company's New England branch in Boston, has been made chief of agency sales, foreign sales and the central station division of the company. This amounts practically to the general sales supervision of the company, which has increased its business largely both in America and abroad of late. Mr. Baker is treasurer of the Boston Commercial Vehicle Association, for four years he was president of the Boston Electric Motor Car Club, and for three years was treasurer of the Electric Motor Vehicle Association of America. He is a member of the Boston Chamber of Commerce, Boston City club, Engineers' club, National Association of Cotton Manufacturers, National Electric Light Association, Bay State Automobile club and many other organizations.

HIGHER MATERIAL PRICES.

Materials used in the manufacture of automobiles and the tools with which they are produced have shown an upward tendency owing to the war. One of the materials in which this is most noticeable is high speed tool steel, which is an alloy containing tungsten. The greater part of the available tungsten comes from Burmah and Portugal and the latter country has a treaty with England to export it to no other country. The United States got it from England before the war, but it is becoming harder all the time to secure tungsten. Cyanide of potassium, which is used in case hardening, is getting scarce and expensive. Burlap, which was bought in large quantities in Calcutta, is scarce because of the impossibility of getting vessels in which to carry it.

TO TAKE UP "JITNEY" 'BUS.

The Safety First Federation, which is to convene in Detroit in October, is to take up the question of the "jitney" 'bus. At a preliminary meeting of the transportation committee in New York the question was discussed. Richard W. Meade, president of the Fifth Avenue Coach Company of New York City, predicted that 'bus lines would spread rapidly as soon as road surfaced and 'bus construction are improved.

KELLY-SPRINGFIELD NEW MODELS.

Four new models are to be added to the series of Kelly-Springfield trucks, making seven in all, ranging from one to six tons. The four new capacities will be 1½, two, four and six tons. The chief changes for the year are the adoption of the Rayfield carburetor and the casting of the lower half of the crank case in two parts.

The Denby Motor Truck Company of Detroit has reduced the price of its one-ton truck from $2000 to $1475. The 1½-ton and two-ton trucks are now sold for $1650 and $1959 respectively.

A 10 per cent. dividend, aggregating $50,000, has been declared by the Federal Motor Truck Company.

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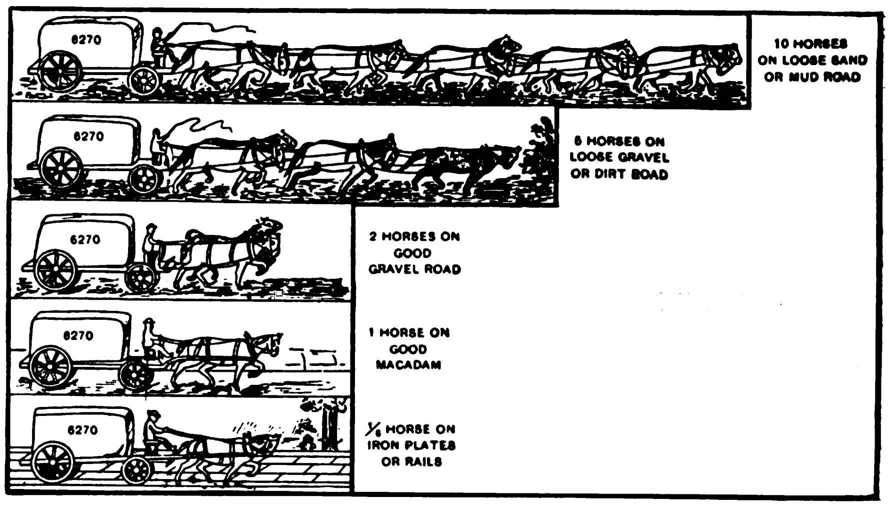
GOOD ROADS AND THEIR VALUE TO THE FARMER.

A DISCUSSION of the problem of good roads written from the point of view of the farmer, which should be very effective in removing the opposition to permanent road construction which farmers in many sections manifest, has been written by S. M. Williams, sales manager of the Garford Motor Truck Company of Lima, O.

Mr. Williams has specialized in the sale of motor trucks for good road purposes for several years and he has made a very close study of the road problem in all its phases. Recently he travelled with a truck, a tent and a moving picture machine throughout the southwest, lecturing on good roads and their benefit on community life. His trip resulted in a great deal of new construction in the large territory which he covered.

He has found that many farmers are opposed to expenditures for good roads because they regard highways as luxuries required only for the accommodation of city automobilists. In his pamphlet, just published by the Garford company, he has hit on the strongest arguments with which this prejudice may be overcome by appealing to the business sense of the rural residents. He shows also the value of good roads in the country to city communities.

He says: "The urban population complains of the high cost of produce. The farmer complains of the high cost of marketing the products. Much of this is due to bad road conditions. Those in the towns and cities say, 'We should not be required to build roads for the farmer,' and the farmer continues to be satisfied with his bad roads, resulting in low efficiency in earning ability and rapid depreciation of his teams. In such communities both the urban and rural population are paying many times the cost of road improvements without securing them."



Graphic Illustration of the Haulage Capacity of Animals on Differing Highway Surfaces with a Load of a Given Weight.

In one county in Tennessee, the writer points out, one bale of cotton was the average load for a team before the improvement of roads began. There are now 100 miles of improved road in that county, and 12 bales is not an uncommon load, increasing the earning ability of the farmers' team 12 times. Some time ago the farmers were notified by telephone of a sudden rise of $4 a bale in the price of cotton. The farmer living upon the bad roads, who could haul only one bale, got a profit of only $4 a load extra. The one living on the good road got an extra profit of $48 on each load. And he hauled the load the same distance in the same time without injury to his team.

In another Tennessee county the cost of delivering wheat from the farm to the railroad, a distance of 10 miles, was reduced for one farmer from 15 cents to four cents by road improvement.

Some astounding figures on the increase in volume and value of produce as the result of good roads are quoted. One county in the South spent $100,000 in five years building good roads and two years after the first roads were laid the volume of freight hauled over them had gone up 45 per cent. Dairy and poultry products showed an increase of 145 per cent. Figuring the decreased cost of hauling on the larger volume of tonnage a yearly profit to the farmers of $41,000 on the $100,000 invested in good roads was shown. On one stretch where the road cost $28,000 the yearly decrease in hauling cost amounted to $14,000, or 50 per cent.

Market prices for farm produce vary considerably during a year. With bad roads farmers are forced to move their crops to market not when prices are most favorable, but when the roads are passable, thereby losing large opportunities for profit. The United States Department of Agriculture figures that the farmers are losing $250,000,000 a year through their inability to get their products to market at advantageous times, owing to bad road conditions.

Several years ago the price of potatoes in a certain town was $1.40 per bushel. Surrounding farmers had large quantities of potatoes, but could not get them to market over their roads, and several carloads were shipped in by railroad before the demand was satisfied.

As soon as good roads are built in any community land values at once increase. In one county in Alabama good roads increased the value of land from an original price range of from $6 to $15 to $25 per acre. The United States department of public roads cites the case of a 100-acre farm in Virginia for which the owner could not get $1800. He fought road improvement, but it went through in spite of him. A little later he refused $3000 for the farm. Another farm on the same road was supposed to have been sold for

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$6000. The purchaser broke the bargain, and then after the roads had been improved bought up the same property for $9000.

A certain state which has only four per cent. of permanently improved roads has one of the best systems of dirt roads in the country. They are kept up by the farmers, who drag them constantly, and the nature of the soil helps to keep them in good condition. The state engineering department estimates that it costs the farmers of that state $11,000,000 annually to move their product to market over the roads. Fully 75 per cent. of the traffic is carried on 10 per cent. of the roads. A permanent surface on those roads would reduce the cost of hauling about 33 per cent. If 10 per cent. of the roads in the state were permanently improved it would mean a saving of from $3,000,000 to $3,500,000 for the farmers, which would go a long way toward paying for road improvement.

Mr. Williams presents the graphic diagram given herewith, showing the horsepower required to move 6270 pounds over various road surfaces. In soft sand or mud 10 horses are required; on loose gravel or dirt, five horses; on good gravel, two horses; on good macadam, one horse; on iron plates or rails, half a horse.

Taking up the social benefits of good roads, Mr. Williams shows that they mean good graded schools, and an active and healthy community social life. Bad roads mean isolation, loneliness, lack of mental development, poor schools and even insanity, as shown by the studies of various sociological bodies.

E. V. A. SHOWS HEAVY GROWTH.

As a result of its activity in 1915, the Electric Vehicle Association has now 16 sections with 1052 members. On a recent tour of the West Executive Secretary A. Jackson Marshall added Kansas City and Portland, Ore., to the list of sections. There are sections in New England, Chicago, Philadelphia, Washington, Cincinnati, San Francisco, Los Angeles, Pittsburg, Detroit, New York City, Cleveland, Toronto, Denver and St. Louis. At the invitation of Samuel Scovill of the Cleveland Electric Illuminating Company, the next convention of the association will be held in that city Oct. 18, 19, 20.

The seventh annual convention of the New England section of the association will be held at Kineo, Me., Sept. 14 to 17. The Electric Vehicle committee will make its report on Friday, Sept. 17.

R. T. Allcut, who for some time has been assistant manager of the New York branch of the Knox Motor Company of Springfield, Mass., has been appointed manager. His territory includes southern New York, Long Island and New Jersey.

A 1½-ton truck for the superintendent of the Monroe county, New York, penitentiary, is to be purchased at Rochester, N. Y. Bids were opened Aug. 18.

SELDEN WORM DRIVE TRUCK.

A two-ton truck, differing from former models chiefly in the use of worm instead of side chain drive, is now built by the Selden Motor Vehicle Company, Rochester, N. Y.

This truck sells for $2250, has 130 or 150-inch wheelbase, and has 36 by four-inch front and 36 by six-inch rear tires. A unit power plant consisting of motor, clutch and gearset is mounted on a sub-frame under a conventional hood.

The engine bore is 4⅛ inches and the stroke 5¼ inches, affording 27.2 horsepower by the S. A. E. rating. The motor has a maximum speed of 1150 revolutions and the truck is governed to a maximum speed of 13 miles an hour.

The motor is block cast with the valves at the left side. The cylinder cooling is accomplished by a vertical tube radiator with circulation induced by a centrifugal pump. The engine governor is a Pierce type driven from the timing gears. A Stromberg carburetor is employed.

There is a dry disc clutch and a three speed selective gearset. The propeller shaft is tubular and three inches in diameter. There are two universal joints between the gearset and the Timken-David Brown rear axle. The steering wheel is at the left side and the control levers in the centre.

MORELAND TAKES OVER BEARDSLEY.

The Moreland Motor Truck Company, Los Angeles, Cal., has taken over the truck business of the Beardsley Electric Company of the same city and will supply parts and service to Beardsley owners. It is said that this marks the passing of the Beardsley truck from the industry. It had been sold for only a few months. The Moreland company will specialize a worm drive truck adapted for using distillate fuel, which has been placed in considerable numbers on the Pacific Coast.

PROTEST FOUR-MILE SPEED LIMIT.

The Montreal Trade Association has adopted a resolution asking the city government to repeal the legislation limiting the speed of motor trucks to four miles per hour, suggesting as an alternative 14 miles for light vehicles, 10 miles for rubber tired trucks, and six miles for steel tired tractors or trailers.

The two millionth magneto built by the Bosch Magneto Company of New York City was recently sold. It is a specimen of type ZR6 for a six-cylinder motor.

To increase its production the American Piston Ring Company of Newark, N. J., recently moved into a larger plant at 696 South Eleventh street, that city.

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REO SHAFT-DRIVEN 1500 POUND DELIVERY WAGON.

TO MEET the demand for a light and quick delivery wagon of 1500 pounds capacity, the Reo Motor Truck Company is now handling a machine known as model F, which has many of the features of design and is built of the same high-grade material as model J, the two-ton truck marketed for several years.

This new type, which is built to meet the requirements of service as established by the Reo company's long truck experience, is the development of a design worked on for two years by Reo engineers. Experimental machines were driven cross country for thousands of miles under varying conditions of load and roads and then torn down and inspected. To insure long endurance and service all parts are designed with 50 per cent. excess strength.

The motor is rated at 35 horsepower. It is a four-cylinder type, with the cylinders cast in pairs, with the heads integral. The cylinders have 4⅛-inch bore and 4½-inch stroke. The lubrication is by a plunger pump that forces oil to the main bearings and timing gears, the excess supplying a constant level in the engine base for splash oiling the pistons, cylinders, wristpins, cams, camshaft and valve tappets. The poppet valves are exceptionally large. The inlet is in the head, with 1¾ inches clear diameter and the exhaust valve is at the side. The connecting rods are light heat-treated I section drop forgings, 9½ inches long, with 1½ by 2¼-inch bearings of high pressure babbit.

The pistons are of a uniform grain cast iron, with two three-piece piston rings. The crankshaft is of drop forged manganese steel, heat treated and ground. The main bearings are nickel babbit, 1½-inch diameter by 2¾-inch length in the centre, and four inches long in the rear. The bearings are adjustable from the exterior of the crank case. The cams are forged integral with the camshaft, which is mounted in die cast bearings. The timing gears are a helical type. The motor is mounted on the sub-frame at four points.

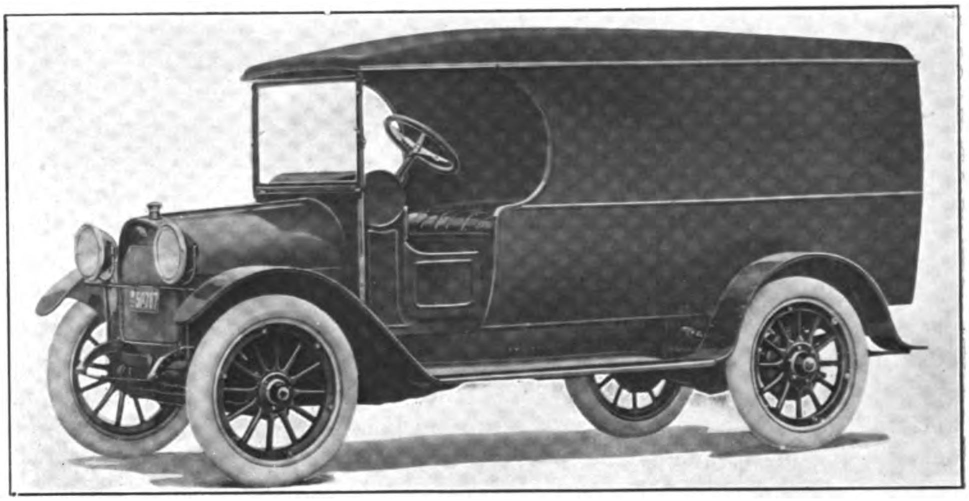
The carburetor is a float feed automatic type and is water jacketed. The air intake is connected with a stove on the exhaust manifold. The air supply is controlled from the dash. The ignition is by jump spark current supplied by the Remy generator, which also keeps the storage battery charged to supply the electric lights and electric starter.

The starting and lighting system is the Remy two-unit six-volt. The starter is mounted over the front end of the transmission gearset, and there is a 100 ampere-hour storage battery. Two large parbolic headlights are fitted with a dimming device that save two-thirds of the current ordinarily used. There is an instrument lamp and a tail lamp.

The clutch is a dry disc type, with 13 plates. The sliding selective transmission gearset has three forward speed ratios and reverse. The gears are case hardened and have ⅞-inch faces. Hyatt roller bearings are used throughout. The drive is through a propeller shaft of heat-treated carbon steel, with two enclosed universal joints, from the transmission gearset to the bevel gears in the rear axle.

The gear reductions from the engine to rear wheels are four to one on high, 7.2 to one on intermediate, 14.8 to one on low and 20 to one on reverse. Two sets of brakes, internal expanding and external contracting, operate on rear wheel drums 14 inches in diameter with 2¼-inch faces.

The rear axle is a full floating type. One or both shafts may be removed without jacking the car, thus allowing the withdrawal of the differential and drive gears. Timken bearings are used for the differential and the rear wheels. The pressed steel axle casing is electrically welded into a one-piece housing, which is very rigid. The front axle is a drop forged I beam section, with integral yokes. It is fitted with one-piece drop forged steering spindles.



The Reo Shaft Driven 1500-Pound Capacity Delivery Wagon Chassis with a Rear Door Full Panel Body.

The wheelbase is 120 inches, with 56-inch tread. The wheels are artillery type of second growth hickory. The front wheels have 12 spokes 1⅜-inch diameter, and the rear wheels have 12 spokes 1½ inches diameter. The tires are 34 by 4½ pneumatic, with plain tread in front and nobby tread at the rear.

The drive is left side, with centre control levers. The truck has a turning radius of 22½ feet. The price complete, with a standard express body and canopy top, is $1075 f. o. b. Lansing, Mich. The chassis only is sold for $1000.

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FAVOR AMERICAN TRUCKS.

Internal Gear Driven Machines Prove Economy in England.

With the shutting off of England's supply of internal gear drive trucks from the makers of the continent, and the devotion of the English truck factories to producing munitions of war, a flood of American trucks has reached London. This demand is likely to be continued even after the war.

The illustration which accompanies this article shows an American made internal gear drive truck at work in London. It is a Burford truck, made by the H. G. Burford Company of Fremont, O. This is a new company which took over the business of the Lauth-Juergens Motor Car Company and of which Albert F. Mais, well known in the American truck industry, is chief engineer and factory manager.

H. G. Burford, who supplied the capital for the new venture, is a London manufacturer and dealer of motor trucks in the highest standing. Before the war he handled internal gear drive trucks made in Austria and Germany, and when he could no longer obtain trucks from that source, or from the English factories, he turned to America.

He was greatly impressed with the quality of American trucks and the prices at which they are sold and decided to push them in London under his own name. The truck illustrated is operated by one of the largest dairy companies in London—the Great Western and Metropolitan Dairy Company. He has also placed 30 trucks of the same make in service as omnibuses in the English metropolis.

The satisfactory service given by the American machines now in use is leading to a rapidly increased demand for more, and if the war continues a large part of England will prefer the American product.

American-Built Truck, a Burford, Formerly Fremont-Mais, of a Fleet Operated by the Great Western Metropolitan Dairy Company of London, England.

FARMER USES ONE-TON KISSEL.

To haul the milk from 20 head of cows to St. Paul, Minn., and also to take to market squash, lima beans, melons, sweet corn, potatoes and small grain, Edward Franzmeier, a farmer, has been using a one-ton Kissel truck instead of horses.

With the horses he got up at midnight, started to market at 1 a. m., arriving between 4 and 4:30. He got back about noon with himself and his horses too tired to do other work. Now he gets up at 4 o'clock, starts at 4:15 and arrives at the market at 5 o'clock. He is back on the farm at 7 ready for a day's work.

He says that it would be impossible now for him to do without his truck and he is entirely satisfied with the one he has. All his hauling is done with it and his horses are reserved for work in the fields.

WINDOW DISPLAY OF TIRES.

The Goodyear Tire and Rubber Company believes that an attractive display of tires in a dealer's windows are as important to the tire business as similar displays are in the department store and other lines. The company has secured the services of Charles Speed, formerly the expert window display man, employed by the Marshall Field Company of Chicago, to work out displays. These are made up and photographs and charts are then sent to dealers so that they may put the displays in their own windows.

CONDITIONS OF FIRE ENGINE TESTS.

Conditions under which the International Association of Fire Engineers will test out gasoline pumping engines at its annual convention in Cincinnati beginning Aug. 31, have been announced. Each maker will be required to rate his engine at a certain number of gallons per minute at 120 pounds pressure, at 200 pounds pressure and at 250 pounds pressure.A preliminary test will be held to determine whether the ratings given are accurate. Suction pipes will be limited in size with relation to the capacities of the pumps at various pressures. The actual test will continue for 12 hours, with six hours pumping at 120 pounds pressure, three at 200 pounds and three at 250 pounds. Speed of the engines will be recorded, as will the amount of gasoline and oil used. Gasoline of the same grade will be supplied by the association to all the demonstrators.

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CUTLER-HAMMER GARAGE CHARGING EQUIPMENT.

CHARGING apparatus for electric vehicles which has the advantage of unlimited expansion of facilities without material changes or great expense is afforded by the unit rheostats built by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., which has branches in many cities.

Every rheostat unit contains all necessary devices and is constructed and arranged to eliminate all chance mistakes, so that a minimum of technical knowledge is required for the successful operation of the system.

Unit panels are supplied, which are mounted on frames carrying five or six panels. Additional panels and frames can be added at pleasure as greater facilities are required. Each panel carries a meter, switch and automatic protective devices.

Charging Equipment at the Corey Hill Garage, Brookline, Mass.

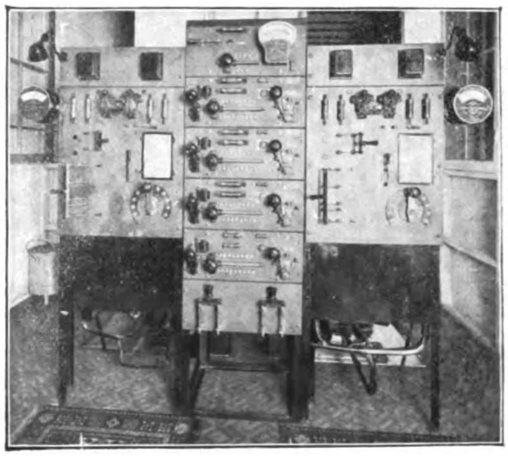
Automatic protection is supplied against over-charging. As soon as the capacity of the battery is reached the flow of current is stopped, so that the batteries cannot be damaged through excessive charging. This same protection applies to excess voltage, which might buckle the plates or do other damage in the accumulators.

Hence it is only necessary to start the charging and the apparatus then requires no further attention. These rheostats are designed to be placed on the walls above or below the switchboards, or on the floor. Small sized rheostats for charging ignition batteries are also supplied.

Adapted for Expansion.

The original installation in any garage may consist of only one or two units, or any number that is desired. The Ward Baking Company has recently installed a switchboard of 35 duplex panels to charge the batteries in its fleet of electric trucks used by its branch in Boston. This installation was adopted as a result of the successful use of Cutler-Hammer equipment by the same company in its New York garage.

The rheostats are exceedingly simple and there are no costly parts to be renewed from service. Each unit is furnished fully wired, so that only the service and battery leads need be attached, and lugs are provided so that such attachment can be made quickly and easily.

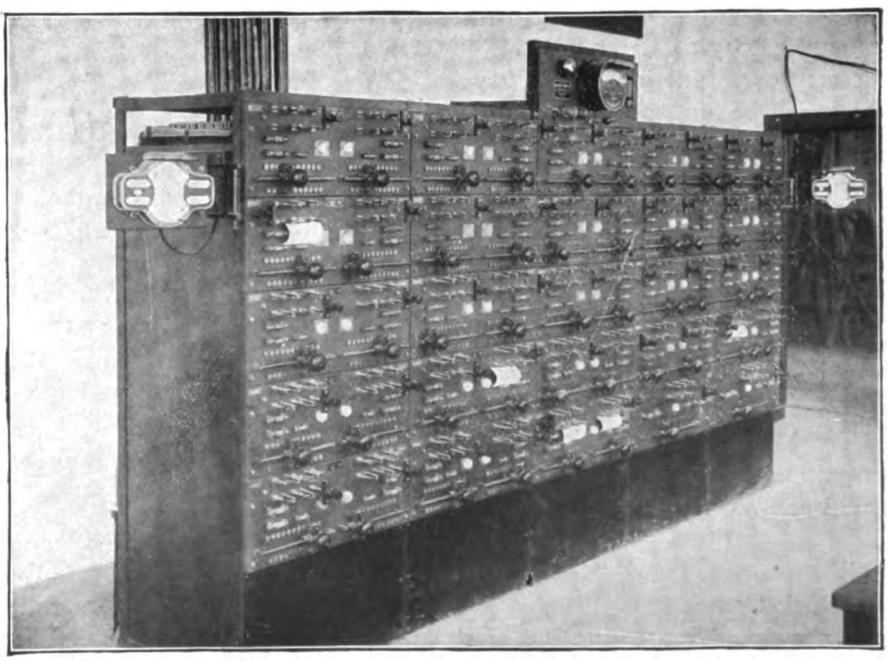


Battery Charging Switchboard at Garage of A. B. Hasting & Sons, Campello, Mass.

One meter on the incoming line serves any number of charging units, which makes it convenient for the operator and reduces the cost of the equipment. It is possible always to read the meter without opening the circuit. A switch for this purpose is located on each unit.

Features of 48-Unit Installation.

In the 48-unit system recently installed in the garage of the Electric Vehicle Association in New York, the switchboard consists of five slate panels, with a swinging bracket on each side for the voltmeter and ammeter. In addition to the usual equipment for each panel the middle panel has a balancing ammeter and a regulating device.



The 48-Panel Cutler-Hammer Switchboard, with Unusual Features, in the Garage of the New York Electric Vehicle Association.

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The charging outlets are so arranged that each car can be charged in its regular position without shifting or moving. Of these outlets 28 are rated as 25 ampere outlets, 18 are 50 ampere outlets and there are two 100 ampere outlets for heavy charging and boosting.

The capacity of the 25 ampere outlets runs up to 35 amperes, and that of the 50 ampere outlets to 60 amperes. The equipment can take care of all types of batteries from 24 lead cells with a charging rate of eight amperes to an Edison battery of 60 cells requiring a charging rate of 100 amperes. The total capacity of the plant is 2500 amperes.

When the plug is attached to the batteries a signal is automatically flashed on the switchboard, indicating that the switch can be thrown in for charging the batteries. The average charging time is from four to six hours. The attendants enter on a card every half hour the current furnished and the battery voltage. The time of charging, number and name of car owner and other data to make a complete record are also included on the card.

The cut in which the electric coupe appears shows the Corey Hill Garage in Brookline, Mass., where only four units are required to care for the business. Another cut shows the equipment of the garage of A. B. Hastings & Sons, Campello, Mass., where four charging panels are installed, and two rotary convertors are used to change the alternating current supplied by the lighting company of Campello to comparatively low voltage direct current. Equipment is also supplied to step down a high voltage direct current to the proper voltage for charging.

NEW TRUCK AND CAR MANUFACTURER.

The Lenox Motor Car Company, now of Boston, will be removed from that city with the completion of its new factory at Lawrence, Mass. The company is to start the production of 1000 trucks for war service, which will be built at both plants, while the designers are working out the details of the new passenger car models.

The company is controlled by a number of wealthy New England business men, who have been successful in other lines. It is headed by Daniel N. Howard, vice president of the Emerson Shoe Company, and strong Boston and Brockton interests are represented in its board of directors.

The Mogul Motor Truck Company, St. Louis, Mo., has purchased a factory site 125 by 187 feet on which it will erect a plant for the manufacture of trucks.

Elias Lange, recently president of the Lange Motor Truck Company of Pittsburg, Penn., has recently been appointed representative in the Pittsburg territory for the Harwood-Bailey Company of Marion, Ind., and will handle the sales for the Indiana truck.

TRUCK TIRE FIGURES.

C. W. Martin, manager of the truck department of the Goodyear Tire and Rubber Company, Akron, O., points out that there are large profits in the handling of truck tires, which, he states, have "arrived". He estimates that a truck uses an average of $175 worth of tires a year. "Up to a year ago", he states, "truck tires were regarded by the average dealer as a necessary evil, something that concerned him very remotely. The situation has changed. In small towns, in the past, truck users have had to buy tires out of town. This meant delays. By buying his tires at home the truck owner gets service, eliminates costly delays and patronizes home industry. We, as manufacturers, benefit because we no longer need to be retailers, in competition with legitimate dealers everywhere. Dealers selling Goodyear motor truck tires are this year centering their efforts on the Goodyear S-V tire, with remarkable success. In towns where presses are not available, the demountable type is the favorite. We are greatly pleased with the progress thus far, and predict that soon truck tires will be sold as universally by dealers as are pneumatics at the present time".

MOTOR TRAFFIC INCREASE SHOWN.

A census of traffic on certain Milwaukee county roads taken in 1911, and another one made in 1914, furnish a standard to judge the growth of motor traffic in that part of Wisconsin. In August, 1911, 39 motor vehicles passed a certain point between 7 a. m. and 10 p. m., while in 1914, 1373 passed the same point. Twenty-nine motor trucks passed another point as compared to three in 1911. This shows the great increase in the number of motor cars used, as well as the attraction of motor traffic by concrete roads, as the highways on which the census were made were paved with that material in the interim.

INTERNATIONAL NOT TO REORGANIZE.

Reorganization of the International Motor Company, which was regarded as probable to reduce capital, will not be necessary, as the company's earnings from war orders and domestic sales are now accumulating at the rate of $90,000 a month. At the end of the year $700,000, which is equal to 19 per cent. on the preferred stock, will be on hand.

HANNIBAL TRUCK FOR $500.

The Hannibal Wagon Company, Hannibal, Mo., is about to place in the market a 1200-pound motor wagon to sell for $500. The motors are now being made by a Detroit manufacturer and are rated at 25 horsepower. An initial order for 100 trucks is said to be already in hand.

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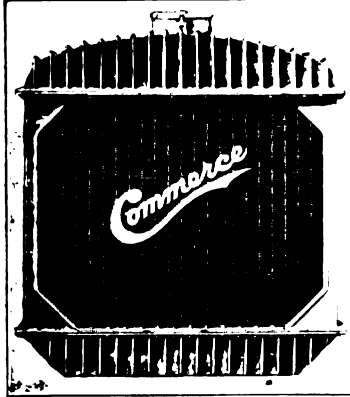
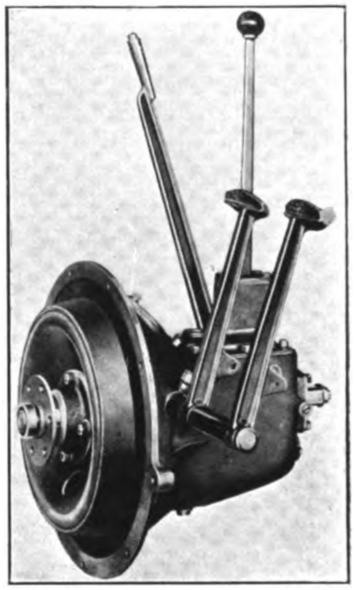


MOTOR TRUCK Capacity 1500 Pounds

SPECIALIZING one type of chassis, a shaft-driven machine with load capacity of 1500 pounds, which is equipped with any one of three standard bodies,the Commerce Motor Car Company, Detroit, Mich., now in the sixth year of active motor vehicle manufacturing, has plans for the largest production since its organization. This chassis, known as model N, is sold with any of the three types of body at Detroit for $975, and it is maintained by the company to be the best, as well as the cheapest machine it has ever built. With a new steel and concrete building 300 feet by 80 feet the estimated 1916 production approximates 3000 vehicles.

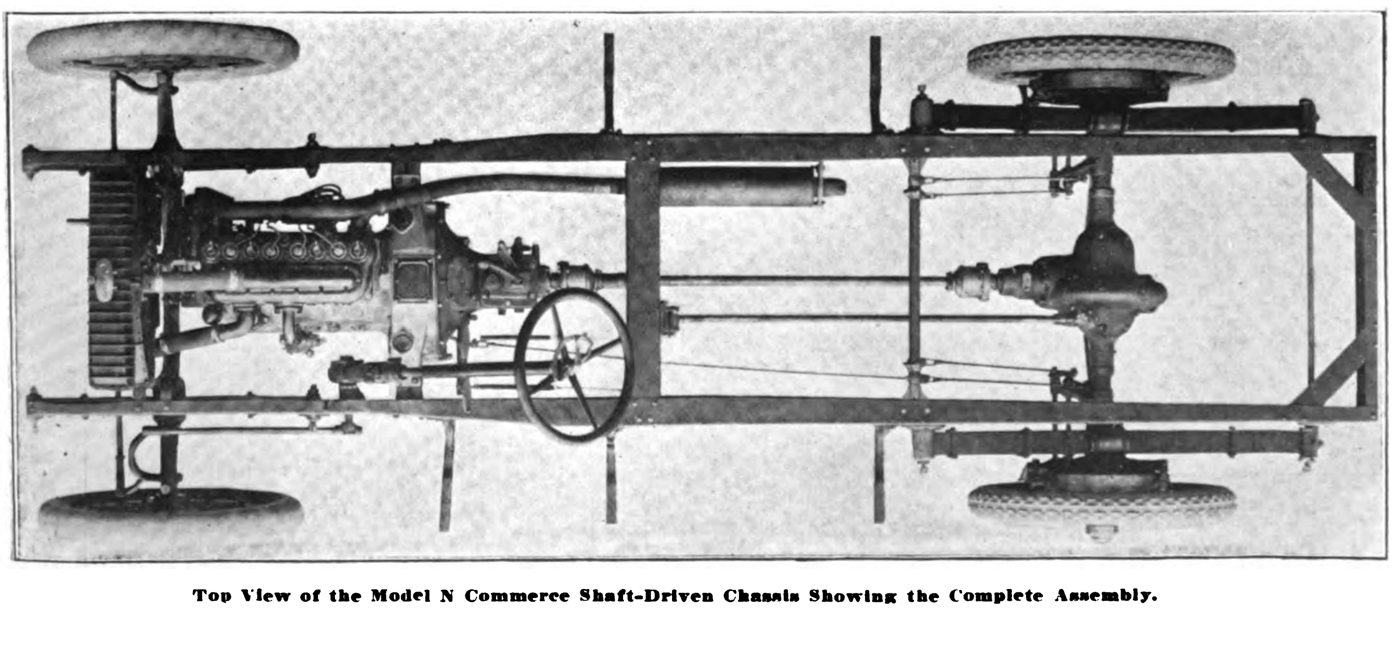
The bodies are designated by letter, model NA being an open flareboard express body with folding top over a seat with a lazyback, model NC a full panel body with tail gate or rear doors, and model NH an express body with standing top and open sides and end. Model N is the sixth distinct machine that has been designed, and this has been perfected with the purpose of meeting a very general demand for a vehicle suited for fast, light delivery, that has sufficient strength to endure very large mileage over city streets and country roads, that has adequate power for any service, and has such simplicity and accessibility that it can be maintained with the least labor and expense that is consistent with operating requirements.

The chassis is constructed from abundantly proven components which are built by some of the best known specialists of the industry. These are recognized as standards by those who have knowledge of motor vehicles and are the highly developed products of concerns of acknowledged stability. large factors of safety insure long service and the construction is such that any necessary work of adjustment and restoration can be done in any garage or shop.



Commerce Clutch and Gearset Assembly.

The power plant is a unit type combining the clutch and transmission gearset, that is suspended at three points,—from a trunion mounted on a special frame cross member at the front and from arms supported by the frame side members at the rear, this insuring against stresses from chassis distortion. The motor is a continental model N, which



Top View of the Model N Commerce Shaft-Driven Chassis Showing the Complete Assembly.

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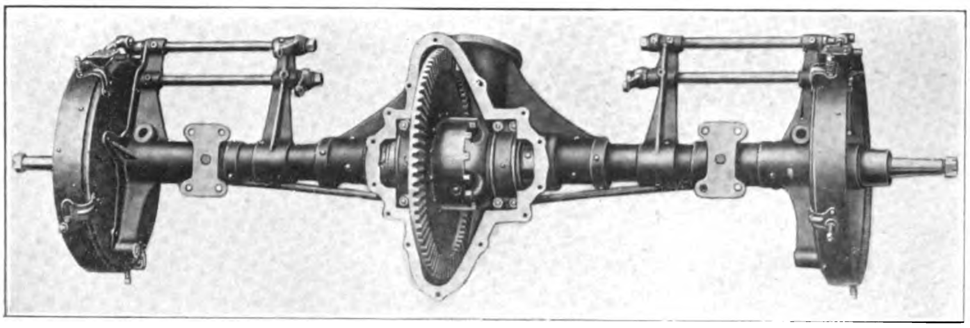


Top View of the Three-Quarters Floating Rear Axle with the Housing Cup Removed.

is a four-cylinder four-cycle water-cooled L-head type with bore of 3½ inches and stroke of five inches, having a bore to stroke ratio of 1:1.427, and a rating by the S. A. E. formula of 19.60 horsepower. Because of the long stroke this engine will develop more than 25 horsepower.

The cylinders are cast en bloc with the water jacket open, this being closed by a large cover plate that is channeled from either end to the outlet manifold at the centre. This plate is retained by a series of cap screws. The valves are at the right side. The cylinder block and the pistons are cast from a fine quality of gray iron and both are extremely well finished. The pistons are made four inches in length and with walls 3/32 inch thickness. These are machined for three compression rings having 3/32 inch faces above the wristpins.

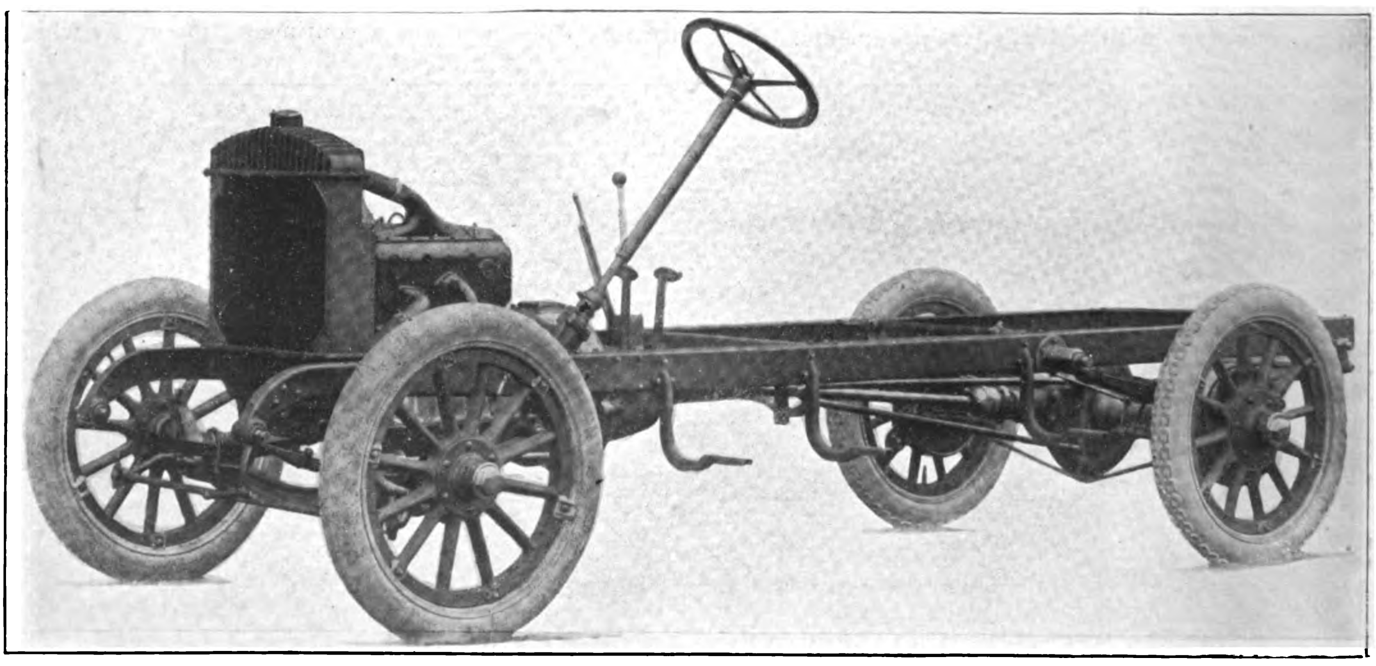
Crankcase of Aluminum.

The crankcase is an aluminum alloy upper section, with a central vertical transverse web that carries the center main bearing and it is formed with a bell housing that encloses the flywheel. The rear supporting arms are cast integral with this housing. The lower section of the crankcase, which serves as an oil reservoir, is pressed steel. By dropping this reservoir the main and connecting rod bearings may be easily reached. There is an opening in the forward left side of the flywheel housing for the fitting of the driving pinion of an electric starting motor, this being covered with a plate. The crankshaft is made of high grade steel, carefully machined and ground, which is carried on three bearings, these being from front to rear 2 3/16, 2 7/32 and 2¼ inches diameter, and 2 9/32, 2½ and three inches length. These bearings are nickel babbitt, mounted in bronze shells. The flange to which the flywheel is bolted is forged integral with the shaft.

The connecting rods are I section steel drop forgings that are bored and reamed on special machines to insure correct alignment. The wristpins are chrome nickel steel, hardened and ground. The crankpins are 1⅞ inches diameter and 2 3/32 inches length. The bearings are babbitt metal and these are fitted with steel shims. The wristpins are bushed with phosphor bronze, the pins being 1 3/32 inches diameter and 1½ inches length. The camshaft is carried on a forward bearing 2⅝ inches diameter and a rear bearing 1½ inches diameter, these being 1 7/16 and 1¾ inches length respectively.

Valves, Cooling and Lubrication Systems.

The valves are interchangeable, having nickel steel heads welded to carbon steel stems, the stem ends being hardened. The valve tappets and the valves are mounted in substantial guides. The tappets are adjusted by the conventional screws and check nuts. The valve mechanism is enclosed by cover plates retained by wing nuts. The timing gears are helical cut and are practically noiseless in operation. The motor is lubricated by the Continental combination force feed and splash system. The oil is fed to the



Three-Quarters View of a Stripped Model N Commerce Chassis.

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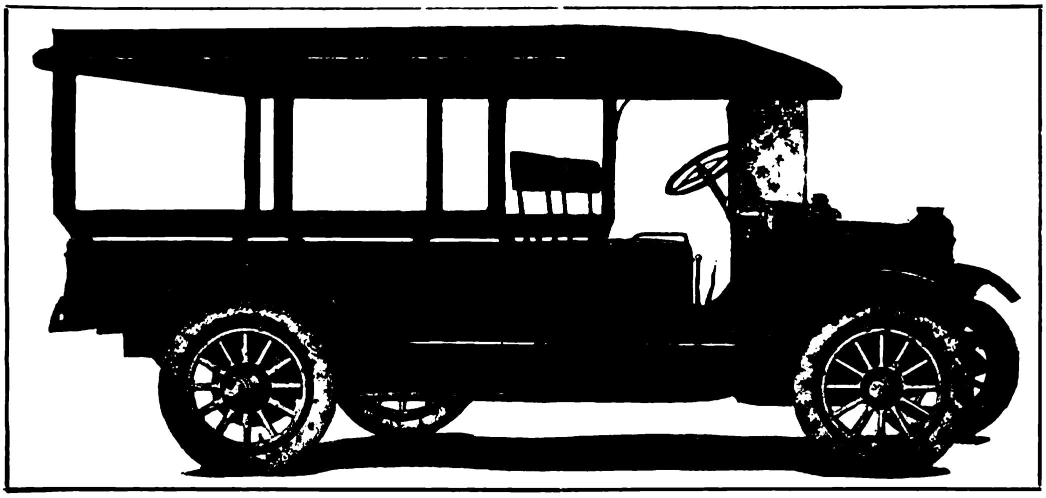


Commerce Chassis Equipped with the Standard Type H Body and Equipment.

reservoir through an outside filler, and after filtration is carried to the timing gears. The overflow drains to the base of the crank chamber where it is distributed by splash to the main, camshaft, connecting rod and wristpin bearings, the pistons and cylinder walls and the valve tappets. A float operated gauge indicates the volume of oil in the reservoir.

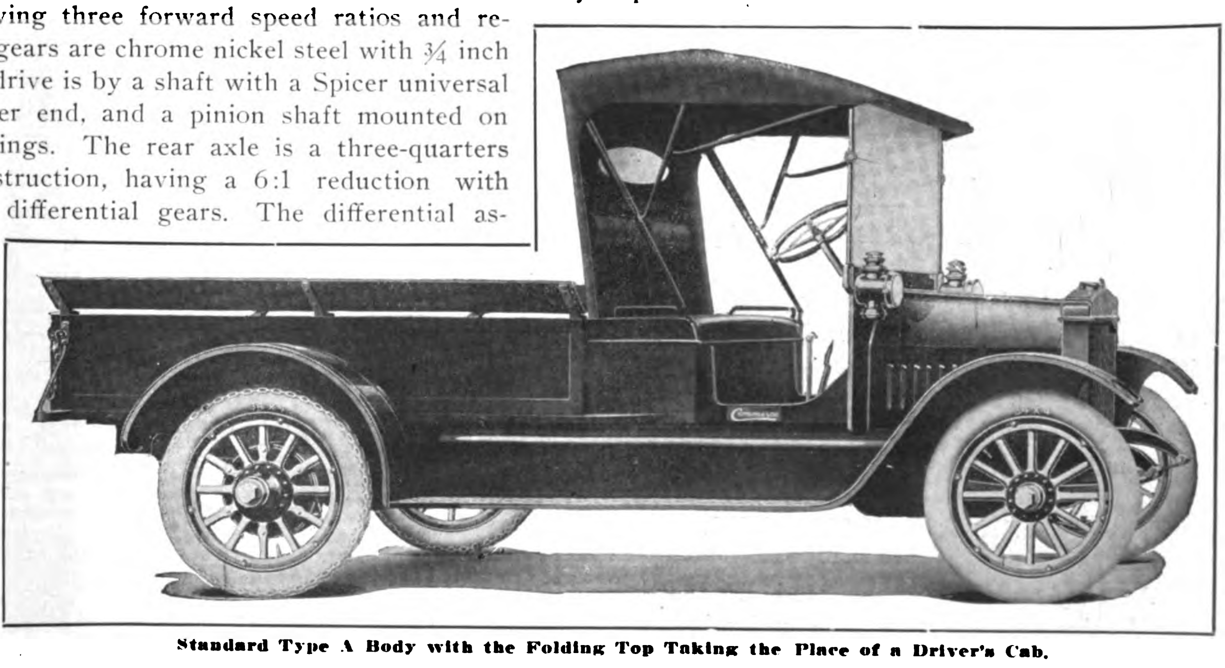
The motor is cooled by a thermo-syphon circulation of water through the large cylinder jackets and the special built four-gallon capacity radiator. This radiator has finned cast steel top and bottom tanks and pressed steel water columns, with a large filler cap. It is mounted on a frame cross member and can be quickly removed or installed. Radiation is promoted by a fan mounted on an adjustable bracket carried on the forward end of the cylinder block that is driven by a flat belt from a pulley on the forward extension of the magneto shaft. The carburetor is an automatic float feed type and the ignition current is supplied by an Eisemann high-tension magneto.

The Clutch and Driving System.

The clutch is a cone type, 14 inches diameter, and this is assembled with the gearset, a selective construction having three forward speed ratios and reverse. The gears are chrome nickel steel with ¾ inch faces. The drive is by a shaft with a Spicer universal joint at either end, and a pinion shaft mounted on Gurney bearings. The rear axle is a three-quarters floating construction, having a 6:1 reduction with Brown-Lipe differential gears. The differential assembly is mounted on Hyatt roller bearings. The chrome nickel driving shafts are easily removable. The torsion rod is a double-truss construction, having a swivel mounting on a frame cross member, with compensating clips.

The frame is a pressed steel channel section of generous dimensions, well braced and reinforced that is mounted on semi-elliptic front springs 36 inches length and 2¼ inches width, and semi-elliptic rear springs 50 inches length and three inches width. All the spring eyes are bronze bushed and all spring clips are nickel steel and are fitted over semi-circular spring saddles. The front axle is an I section with large spring seats. The steering gear is at the left side and the control levers at the center. There is a throttle lever on top of the 18-inch handwheel. Both sets of brakes operate on the rear wheels, these being internal expanding and external contracting in and on drums 16 inches diameter and 2⅜ inches width. The brake shoes are lined with Raybestos. The muffler is an extra heavy Gray-Hawley construction.

The wheels are artillery type, of wood, fitted with 34 by four inch pneumatic tires, those on the rear wheels being non-skid, on demountable rims. The wheelbase is 120 inches and the tread 56 inches. The chassis is sold with dash and tail lamps, horn, jack and tool kit for $875. The body equipment includes a folding top for the driver's seat of the open express type. The standard bodies have 72 inches length and the special bodies 90 inches length. All bodies are fitted with windshields, storm curtains, and a spare tire rim. Besides the three standard types of bodies special equipment will be built to specification to meet any requirement of the customer.



Standard Type A Body with the Folding Top Taking the Place of a Driver's Cab.

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PRACTICAL MOTOR TRUCK MECHANICS.

REMOVING DENTS FROM RADIATORS.

The removal of dents from the surface of a radiator is not an easy task even for the expert. A method frequently used with much success is as follows: Remove the radiator from the chassis and solder small pieces of tin over all the openings such as water connections, overflow pipe, etc. At the filler opening of the radiator provision must be made for attaching a pump. This connection is easily made by taking an old valve stem and soldering it to the centre of a piece of tin as shown in Fig. 25 A. After it has been ascertained that all openings have been closed, the radiator should be subject to air pressure. A small, smooth block should then be placed at the edge of the dent and lightly struck with a hammer. Repeat the operation entirely around the dent and the air pressure will gradually force out the uneven part. Of course judgment should be shown as to the amount of air pressure required. Another good method is to plug all the openings except the filler opening and then fill the radiator with water. A tight fitting cork should then be driven into the opening, the result being that the water is subject to slight pressure. Proceed as above to remove the dent, the water furnishing the means for pressing out the dented section.

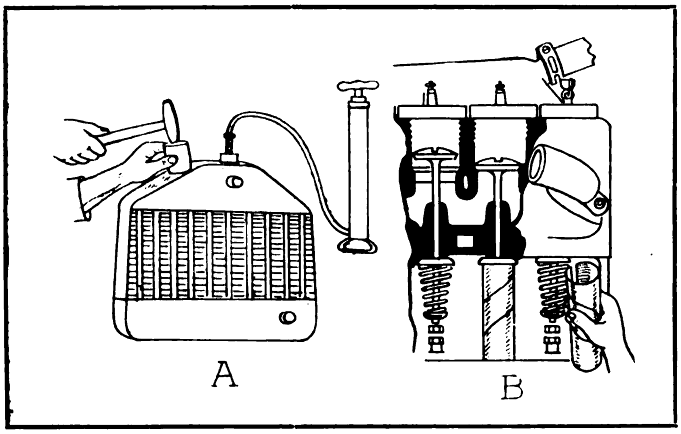

Fig. 25—A, Removing Dents from Radiator with Air or Water Pressure; B, Inexpensive Silencing Noisy Valve Stems and Tappets.

CEMENT FOR BATTERY JARS.

A cement adapted to battery jars, made from fibre or similar material, and which is not effected by acid, is made as follows: Mix two parts of powdered asbestos, one part of ground baryta and two parts of sodium water glass solution. This cement will also unite metal.

ENCLOSING VALVES.

An easy and inexpensive method of enclosing exposed valve parts on a gasoline engine is illustrated in Fig. 25 B. Obtain an ordinary cardboard mailing tube which is slightly larger in diameter than the valve spring. Measure the height of the parts to be enclosed and then cut the tube accordingly. With a sharp knife cut a slit from end to end. If care is taken the tube may be spread sufficiently to pass around the parts. When in position it may be painted to any desired color. Besides keeping the parts clean, the shield will greatly reduce the noise of the tappets.

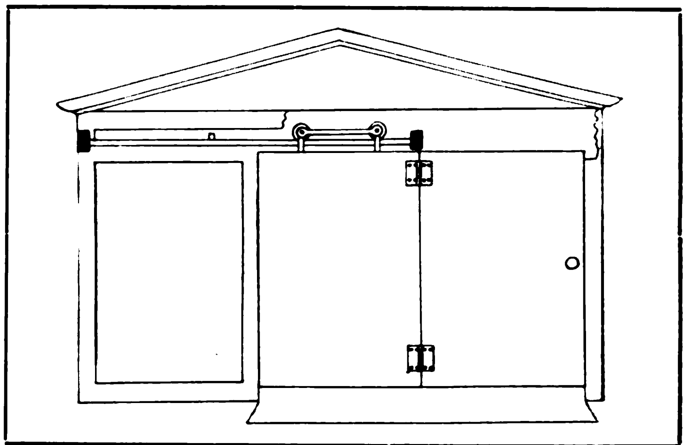

Fig. 26—Combination of Rolling and Swinging Door for Small Garage.

SOLDERING A WATER JACKET.

If the pressure to be withstood is not too great a crack in a cylinder water jacket may be repaired by soldering. Some copper sulphate or blue stone is dissolved in water and the sides of the crack are painted with it several times until a coating of copper begins to appear. This surface will retain solder and usually that will make a very satisfactory repair.

A WIDE DOOR FOR A SMALL GARAGE.

Circumstances will sometimes require the mounting of a large door of a small garage on rollers, but should width of the building not permit a track of sufficient length, the situation can be met by the use of two doors hinged together. One door is fitted with rollers at the top which run on a track, as shown in Fig. 26. If the hinged door is very heavy, a small weight

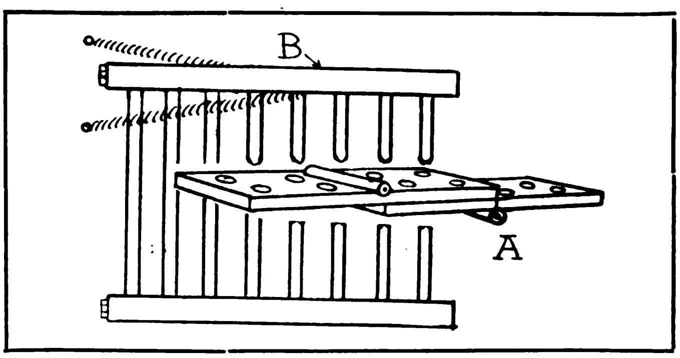

Fig. 27—A, Arrangement of Hinges for a Double Swinging Door or Gate; B, Spring Adjustment for a Gate.

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should be attached to the lower left corner of the door mounted on rollers to serve as a counterweight. It is a good policy, however, to have the door on rollers the heavier of the two, so that no weight will be necessary. It is obvious that when the hinged door is folded back the two may be pushed back on the track as a unit, thus allowing a full door space.

FINDING LOOSE BEARINGS.

A common method of determining play in the main bearings of an engine is to grasp the connecting rods or shaft with the hand or pry them with a bar. While this test may be made with more or less success, a better and more accurate adjustment may be effected if the operation be done as shown in Fig. 28. Remove the lower half of the crank case and place the pistons on dead centre. The jack head can now be placed under the lower half of a connecting rod bearing and any play either in the rods or main bearings may be easily

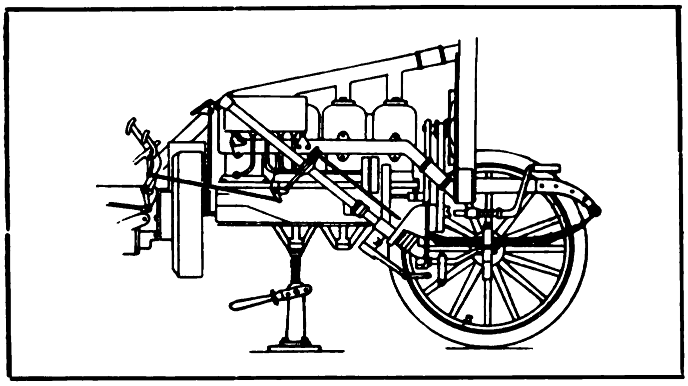

Fig. 28—Determining Play in Main and Connecting Rod Bearings by Jacking the Crankshaft.

learned as the jack is raised and lowered. It may be advisable after raising the shaft to try to insert thin shims between the lower part of the bearing and the shaft.

DOUBLE SWINGING GATE.

Conditions may necessitate keeping all gates and doors of a garage and repair shop closed, but so adapted that they may be readily opened by the workmen without laying down articles they may be carrying to release the knob or hook. A double swinging hinge may be made by obtaining four butts and riveting them in pairs, the back being together, as shown in 27 A. Of course the end of the door or gate should be recessed to admit the extra thickness. A small coil spring can be attached to each side of the door and if the tension is equal the door will remain closed at all times, as shown in Fig. 27 B.

EASILY CONSTRUCTED ROBE GUARD.

Many large trucks are not so equipped that the driver is protected from rain. This condition necessitates the use of water proof robes that are placed over the knees. Fig. 29 illustrates an easily constructed device which prevents a robe when used with such a truck from touching the foot pedals. It consists of a piece of metal rod a quarter inch in diameter and bent

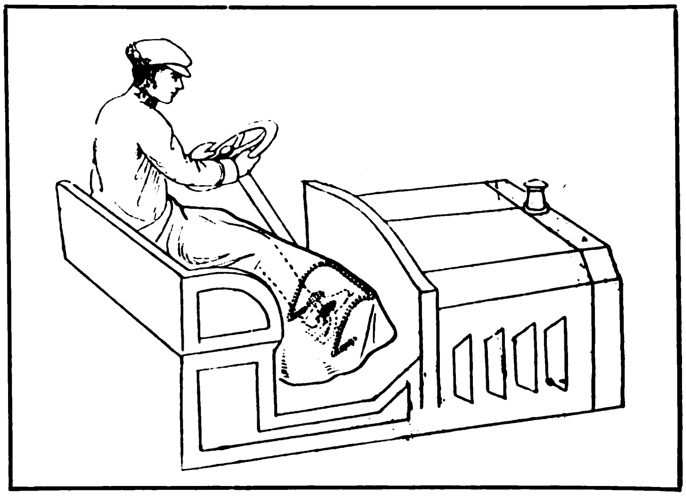

Fig. 29—Easily Constructed Truck Driver's Robe Guard.

as shown. This permits the foot to pass through the guard, but prevents the robe from being drawn in with the pedal.

RETAINING WING NUTS.

Winged nuts are extremely convenient for making easy and quick attachments, but when fastened to any vibrating part they may become loose. This is largely due to balance of the two wings. A simple insurance against a wing nut loosening is shown in Fig. 30 A. File or grind one of the wings so that the nut is not balanced and it will not be affected by vibrations. The removal of part or even the whole of the wing, however, will not prevent tightening or loosening the nut with the fingers.

EMERGENCY SCREW DRIVER.

When a screw driver is needed and there is none

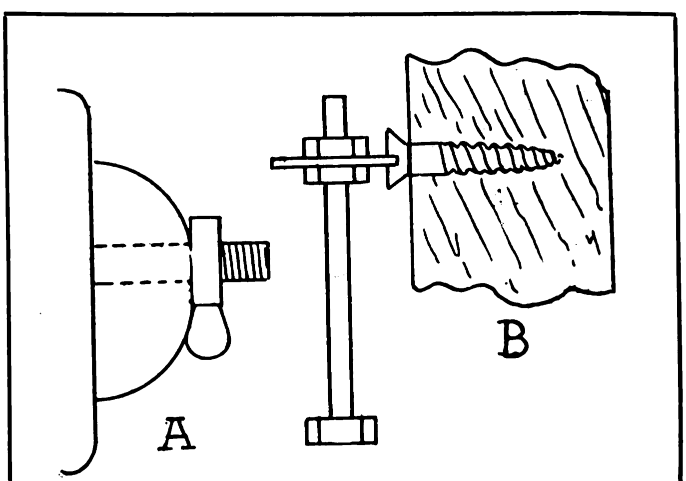

Fig. 30—A, Simple Manner of Retaining Winged Nut; B, Emergency Screw Driver of Bolt, Nuts and Washer.

at hand, a very satisfactory substitute can be quickly constructed, as shown in Fig. 30 B. Select suitable bolt and insert a small washer between two nuts as shown.

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If the washer is too thick it may be filed to the correct height. The washer is used as the screw driver blade and the bolt as the handle, which affords suitable leverage.

NUT HOLDER FOR MONKEY WRENCH.

In the process of removing a nut with a wrench it is frequently dropped and becomes lost. This can be obviated by the simple attachment illustrated in Fig. 31. A groove (A) is cut in the stationary jaw of the wrench and a small hole (B) drilled and tapped near the outer edge. A spring (C) made of good steel should be attached to the jaw as illustrated. This spring will hold even the greasiest of nuts until the jaws are released.

A HANDY HOME-MADE VISE.

An easily constructed vise which may be used to advantage in the garage, consists of a discarded monkey wrench held firmly on a small block by two

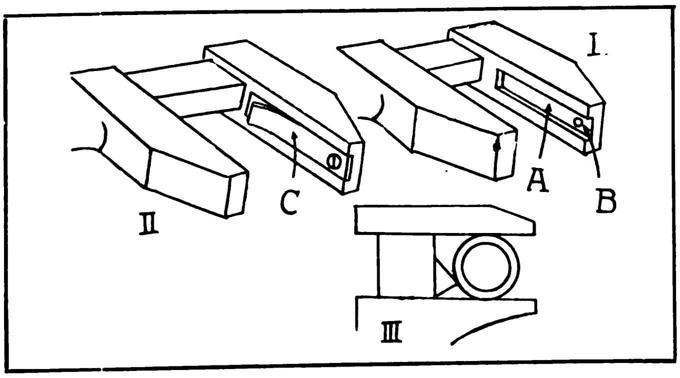

Fig. 31—I, Jaw Slotted for Spring; II, Spring Attached Prevents Nuts from Dropping; III, Broken Three-Cornered File Used in Conjunction with Monkey Wrench for Turning Smooth Surfaces.

L shaped pieces of metal riveted to the stationary jaw of the wrench on one arm and to the block on the other. The handle is secured by a staple, seen in Fig. 67 B. The movable or inside jaw of the wrench is used for clamping and may be operated by the knurled nut attached to the long screw, or the leverage may be greatly increased by drilling two holes at opposite points in the nut so that a small rod may be used as a lever.

HOME-MADE GARAGE HOIST.

A hoist is an essential in every garage and in Fig. 32 A is shown a type that anyone can make at a trifling expense. It can be moved to any part of the garage where there is a convenient ceiling or roof joist. The material required is two hooked pieces and three rings, two of which are oval and the other round. The hooked pieces should be made from steel not less than two inches in width and a half inch thick. Half-inch holes should be drilled three-quarters of an inch and three inches from the end. The first are fitted with the links, while the hinge pins fit into the latter. The hooks are clamped on the joist or beam, the points be-

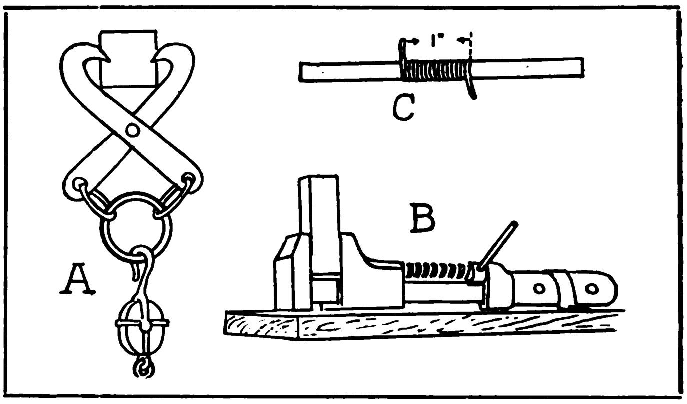

Fig. 32—A, Hoist Which Grips Roof Joist; B, Small Vise Made from Monkey Wrench; C, Method of Determining Wire Diameters Without Gauge.

ing driven in with a hammer. A tight hold is assured, for the greater the strain the deeper the hooks will sink. The strength of the parts should be adapted to the work the device will have to perform.

ASCERTAINING WIRE DIAMETERS.

A simple method of determining the diameter of a wire when no gauge is at hand, is to wind the wire closely around an object until the coils completely cover its surface for one inch. Count the coils and divide the distance by that number. Thus if there are 16 coils to an inch, it is apparent that the wire is 1/16 of an inch in diameter. This method is successful if carefully carried out even with very fine wires, and is illustrated at Fig. 32 C.

HOME-MADE VALVE SPRING TOOL.

The valve spring tool shown, Fig. 33 A, can be made best from a piece of ½-inch round stock. The ends are flattened and a ⅞-inch U opening is formed. The tips can be made tapering by means of a file, so

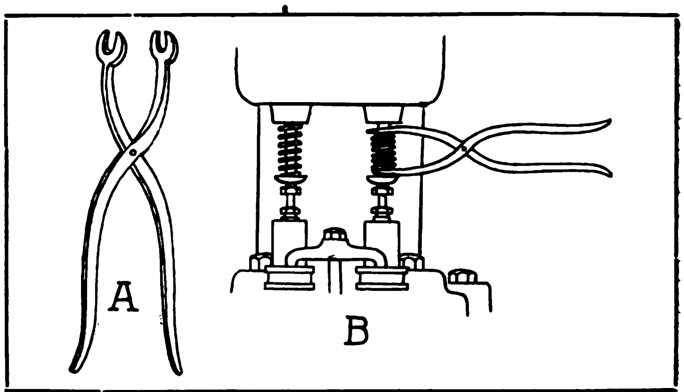

Fig. 33—A, Construction of Valve Lifter; B, Method of Applying Lifter.

that they may be easily forced between the coils of a valve spring, as shown at B. Dimensions can be changed to suit the work.

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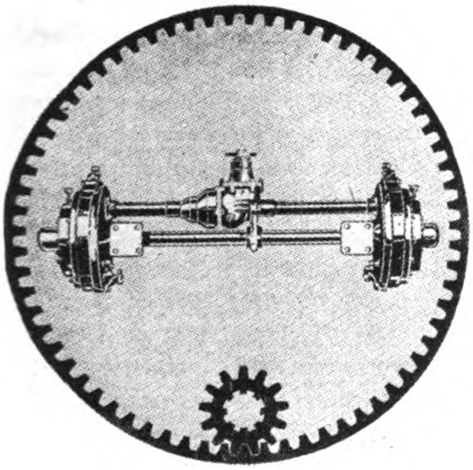


Russel
Internal Gear Drive Axles

AMERICA'S motor vehicle industry has reached its present magnitude because standardization of types, specialized manufacture of parts and great volume of production has made possible prices that are within the financial reach of a great proportion of the people. Each factor has its own particular influence, but none is more potent than part manufacturing, which has developed extremely satisfactory design, and competition has compelled the use of the highest grade materials, the employment of the best of skilled labor and the perfection of processes for obtaining the fullest measure of the qualities of the metals used.

Motor vehicle component production includes all of the units that are required to construct complete machines—not the non-essentials—and the larger the volume of production the greater the necessity of quality and minimum price consistent with quality. Manufacturers of parts have extremely well organized engineering departments, whose endeavors are directed to improvement of design, to insuring the quality of metal that will afford greatest endurance and most satisfactory service, and to the use of production methods that will economize labor and material. These engineering staffs are very efficient, have splendidly equipped laboratories, and systematically study the results obtained from their own products and make comparisons with others of similar character, with the view of constant development of operating efficiency and endurance.

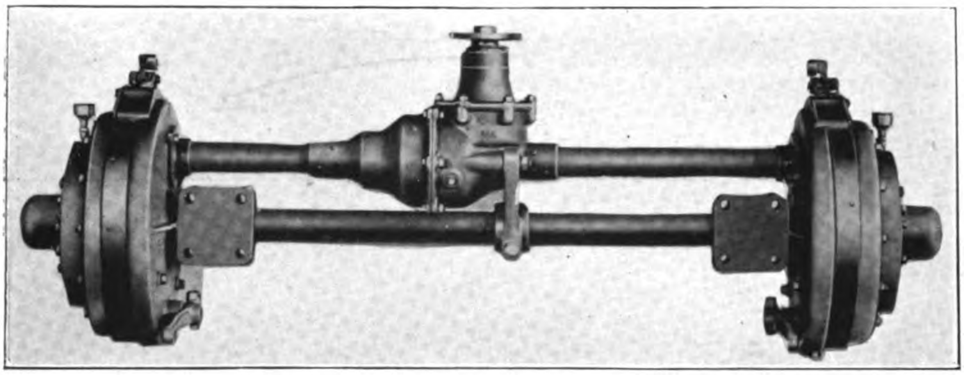
Machines built from specially produced parts are usually sold for prices less than demanded for vehicles constructed in a single shop or works. The truck made of specialized components is recognized as standard, instead of as lacking quality, because it is known to be proven so far as each of its units are concerned, and no part included in it is sold until its practical worth is demonstrated beyond all question.

Some of these specialists are concerns of large proportions, that produce exclusive types very highly developed, and these have plants with special facilities for the production of components that are very generally used throughout the industry. Of these concerns none is better known than the Russel Motor Axle Company, North Detroit, Mich., which has for a long time produced a type of internal gear driven axle that is claimed to have exceptional efficiency. This axle is built in sizes for wagons and trucks having load capacities of 1500, 2000 and 4000 pounds.

American Truck Equipped with Russell Rear Axle, in Service of One of the Largest Retail Drug Firms of London.

While this article will have to do with the Russel internal drive axle in particular, and no description of other products will be attempted, statement should be made that the company has always built axles, and it was created to manufacture a component not only in much demand in the industry, but which required quite as much engineering ability as any assembly entering into a motor vehicle.

The Russel Motor Axle Company was organized in



Top View of the Russel Two-Ton Capacity Internal Gear Driven Rear Axle Completely Assembled.

December, 1909, and it first confined its production to pleasure car axles designed for 2000-pound cars. The future of the pleasure car industry was at that time assured, but at the other hand the use of motor trucks and wagons for freight haulage was barely beyond the experimental stages. It was patent, however, to those who had closely followed the development of the motor pleasure car that the future possibilities of the motor truck industry were so promising that they could not be disregarded. This fact was vividly emphasized by the enormous increase of railroad freight receipts in the United States. In 1907 the railroads received more than $1,000,000,000 for the transportation of freight, and by the knowledge that at least the same amount of money was annually expended in the haulage of freight by other means than railroads.

First Specialized Truck Jackshafts.

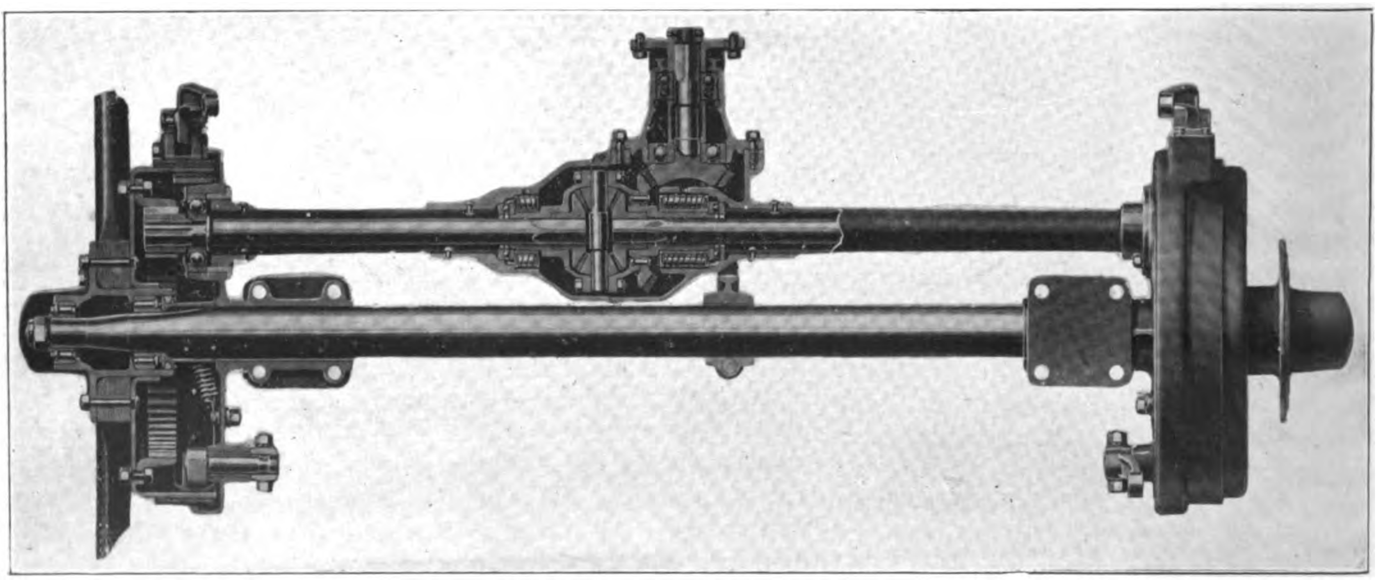
The Russel Motor Axle Company, anticipating the development of the motor truck division of the industry, decided to specialize the manufacture of jackshafts for 2000, 3000 and 4000-pound trucks, and in this was so successful that a majority of all the companies building 2000 to 4000-pound load capacity trucks have used and are now using Russel jackshafts. That the development of the demand for motor trucks has at least equalled expectations is evidenced by the fact that there are now as many service vehicles in use to-day as there were pleasure cars in the hands of private owners in 1906.

The rapidly increasing number of trucks in service impelled axle manufacturers to specialize truck units, and this may be applied to the Russel company in particular, which, through the development of pleasure car axles and jackshafts for trucks, had sought to improve so far as possible the types in use or to adopt designs that would insure greater measures of endurance and economy than were obtained in the then standardized products. This endeaver to perfect the power transmission systems resulted in the production of what is claimed to be in every way superior to the double side chain and sprocket drive, which is extremely variable in efficiency even with the most favorable conditions, as well as noisy, and it is exposed to damage from causes that cannot be guarded against by driving precaution.

Development of Final Drive Systems.

During what may be termed the development period of the industry, it was natural that in seeking a more desirable type of final drive, or a substitute for the chains and sprockets, that American engineers should have given closer attention to the work of English designers and builders than those of other nations because of their knowledge of the language of the former and their inability to obtain equally good data and general information of those using other tongues.

The worm and gear wheel driving system was developed in England largely from the enforcement of the police regulations prohibiting noise, which were not met by the double chain driven omnibuses largely used in London, and eventually the worm and gear power transmission was adopted for all London omni-



Top Sectional View of the Jackshaft and Brake Assembly of a Russel Internal Gear Driven Rear Axle, Showing the Design.

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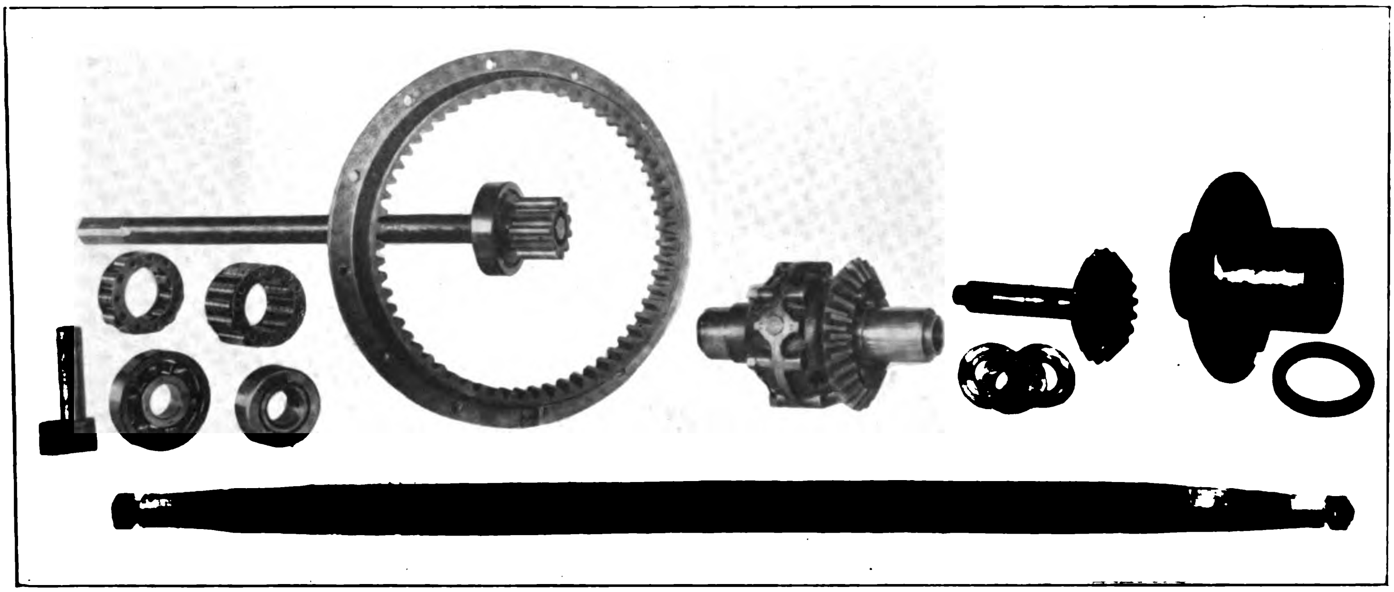
buses. The adoption of the worm and gear wheel as a substitute for chains and sprockets by one of the largest and most conservative of American motor truck manufacturers first directed the attention of the industry and the public to this system. There was no question that the worm and gear wheel was more quiet in operation, and as no other principle had been developed that might be regarded as a factor of importance when weighing the relative qualities of other systems against it, the system rapidly gained favor with American engineers considering the best design of motor truck axles. During the period following the appearance of the worm driven machines in America more chain drive trucks were built than ever before. The engineers, despite the evident variable efficiency and noise of the chain, sprocket and jackshaft, were not willing to turn to what was to them, at least, the untried worm and gear wheel system.

The Russel company in its development work had made by the military authorities of European nations, which extended over considerable periods of time, had resulted in the approval of the internal gear drive; while the fact that a very large number of the omnibuses in Paris and Berlin were built with internal gear drive was substantiation of the results as determined from the experiments of the engineers. In this connection may be pointed out the fact that all of the heavy artillery haulage done by the German, Austrian, Turkish, and, to a considerable extent, by the French and Russian armies, is done by internal gear driven tractors and trucks. The statement is made that the wonderful mobility of the German army is attributed largely to the efficiency of the truck and tractor equipment, which is nearly all driven by internal gear systems.

The test of the specially designed axle thoroughly convinced the engineers of the Russel company that it was the most serviceable and efficient final drive for



Units of the Russel Internal Gear Driven Axle Jackshaft from Left to Right These Being: Brake Shoe Cam, Ball and Roller Bearings of the Differential Gearset, Internal Ring Gear, Driving Shaft and Integral Pinion, Differential Gearset and Crown Gear, Thrust Bearings, Pinion and Shaft of Main Shaft, Wheel Hub and Load-Carrying or Dead Axle.

the co-operation of some of the best of motor truck engineers, both in this country and continental Europe, where the experience with heavy haulage vehicles was even more extensive than in England. During an investigation extending over a period of two years the company's representatives found that the internal gear driven axle system of final drive had been in use for 15 years in Germany, France, Italy and Austria, in which countries it was replacing the chains and sprockets system.

Convinced that the internal gear was the most efficient type of gearing known, and believing that the double chains and sprockets must eventually be replaced in truck construction by a design that would constantly afford a high standard of efficiency, be more enduring and be practically noiseless, the company's engineers designed an internal gear axle and gave it a year's test in very hard service. During this period of test the engineers learned that the trials

motor trucks. It was adopted as a standard product, and the company has met with such success in its sale that the plant has been enlarged to provide facilities for its production. The company has just completed the first unit of a new building that is 200 by 60 feet and two stories height, and the erection of another unit of the same dimensions is contemplated.

A Chain Drive Without Chains.

The Russel engineers state that the Russel internal drive system can best be described as a chain drive without chains, internal gears being substituted for sprockets, and instead of engaging chains these gears engage pinion gears securely attached to the axle shafts within the power transmitting axle. This axle or jackshaft is placed directly in front of the load carrying axle, which is a solid bar of heat treated alloy steel that has great strength. That is, the jackshaft is taken from the position it would have on a chain driven truck chassis and secured rigidly to the rear

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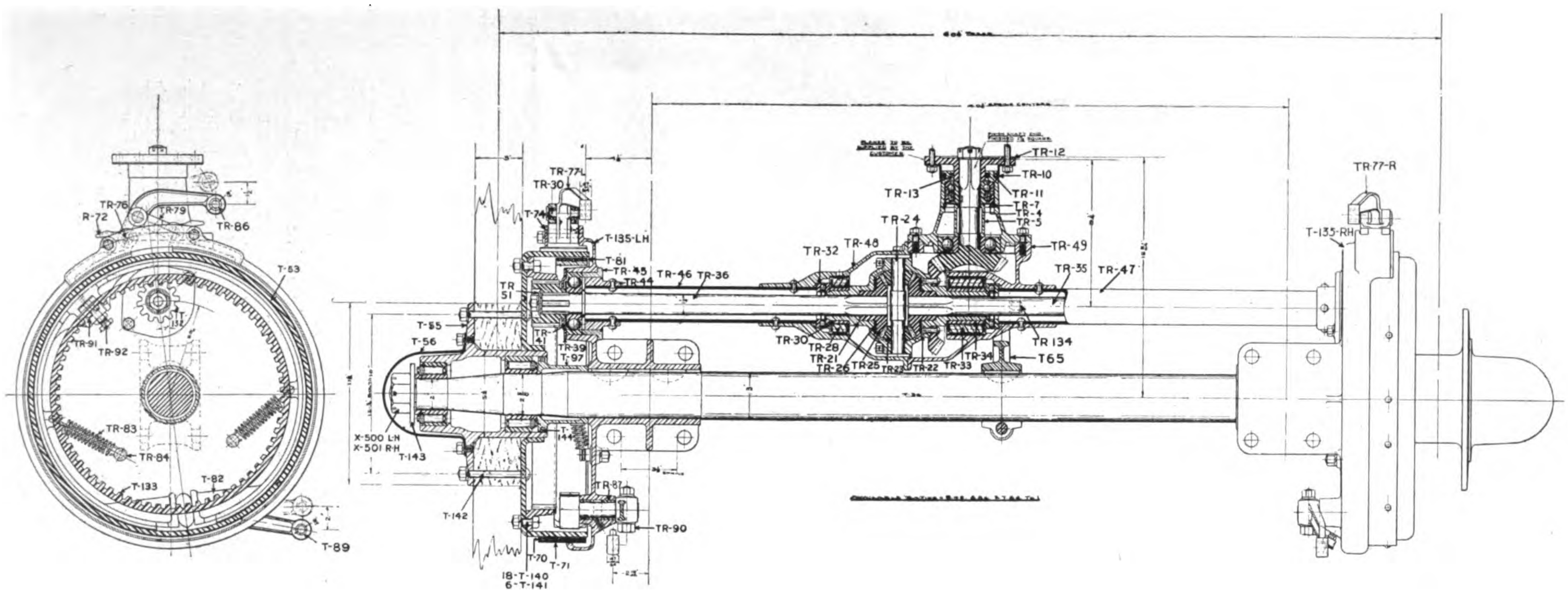
DETAIL DRAWING OF THE RUSSEL TWO-TON INTERNAL GEAR DRIVEN REAR AXLE.



Definitions of Specification Numbers Shown in the Accompanying Illustration Grouped in the Order of Reading the Drawing, from Left to Right.

END ELEVATION.

R	72	External Brake Band Clip.
TR	76	External Brake Band Clip Pin.
TR	79	External Brake Link.
TR	86	Brake Lever Bushing.
T	53	Brake Drum.
T	89	Internal Brake Cam Lever.
T	82	Internal Brake Band.
T	133	Internal Gear 71 Teeth.
TR	84	Internal Brake Band Spring Pin.
TR	83	Internal Brake Band Pin.
TR	91	Internal Brake Band Pin.
TR	92	Internal Brake Band Cap Screw.
T	132	Internal Pinion 12 Teeth.

HUB R-H.

TR	77	R	External Brake Lever, R. H.
T	135	RH	Brake Spider, R. H.
T	142		Hub Bolts, L. H.
T	143		Axle Nut Washer.
X	501		Axle Nut.
T	56		Hub Cap.
T	55		Rear Wheel Hub.
T	74		External Brake Band Dust Shield.
TR	80		External Brake Clevis Pin.
TR	77	L	External Brake Lever.
T	135	LH	Brake Support, L. H.
T	81		Internal Brake Shoe.
TR	45		Jackshaft Tubing Sleeve.
TR	44		Jackshaft Tubing End.
TR	41		Jackshaft Outer Bearing Washer.
TR	39		Jackshaft Bearing Retainer.
T	97		Hub Spacer.
T	144		Hub Spacer Felt Washer.
TR	87		Internal Brake Cam Bushing.
TR	90		Internal Brake Adjusting Lever Worm.
T	71		External Brake Band.
T	70		External Brake Band Shoe.
T	140		Internal Gear Bolts, 7/10" Diameter.
T	141		Internal Gear Bolts, ½" Diameter.

SECTION OF CENTRE.

TR	46	Jackshaft Tube, L. H.
TR	36	Jackshaft, L. H.
TR	32	Differential Thrust Bearing.
TR	48	Jackshaft Housing, L. H.
TR	24	Differential Pinion Pin.
TR	13	Drive Pinion Shaft Oil Ring.
TR	10	Driving Pinion Bearing Oil Guard.
TR	11	Driving Pinion Bearing Oil Ring.
TR	7	Driving Pinion Bearing Split Ring.
TR	4	Driving Pinion Bearing Washer.
TR	5	Driving Pinion Spacer.
TR	49	Jackshaft Housing, R. H.
TR	35	Jackshaft, R. H.
TR	47	Jackshaft Tube, R. H.
TR	134	Jackshaft Yoke Bolts.
T	65	Jackshaft Yoke.
TR	34	Differential Bearing Sleeve, R. H.
TR	33	Differential Bearing, R. H. (Hyatt.)
TR	22	Differential Housing, R. H.
T	36	Rear Axle.
TR	23	Differential Pinion 11 Teeth.
TR	25	Differential Gear 20 Teeth.
TR	26	Differential Gear Washer.
TR	21	Differential Housing, L. H.
TR	28	Differental Bearing, L. H. (Hyatt.)
TR	30	Differential Bearing Sleeve, L. H.

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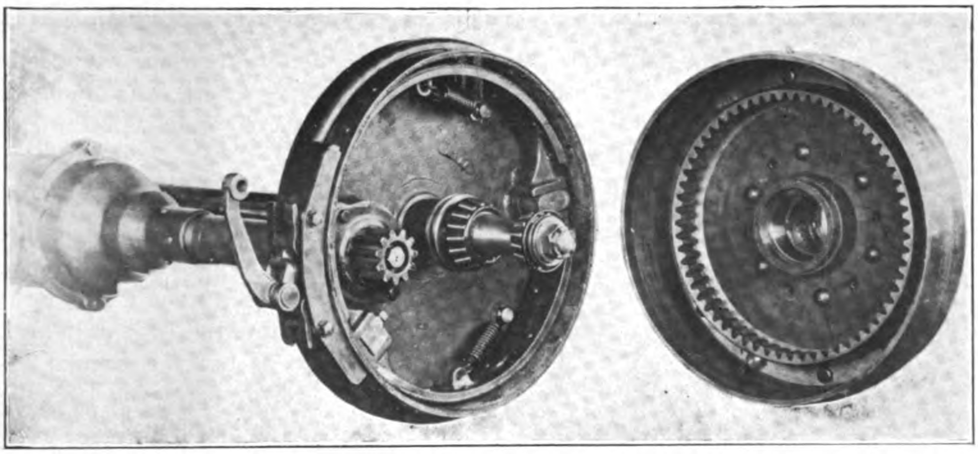


The Brake Drum and Internal Gear Removed from the Russel Axle, Showing the Internal and External Brake Assembly.

axle itself, so that it moves as a unit with it.

As with the double chain drive, the power is applied to the load wheels close to the tires, reducing the driving stresses, yet the unsatisfactory chain is replaced by direct acting gearing that is fully enclosed and thoroughly lubricated.

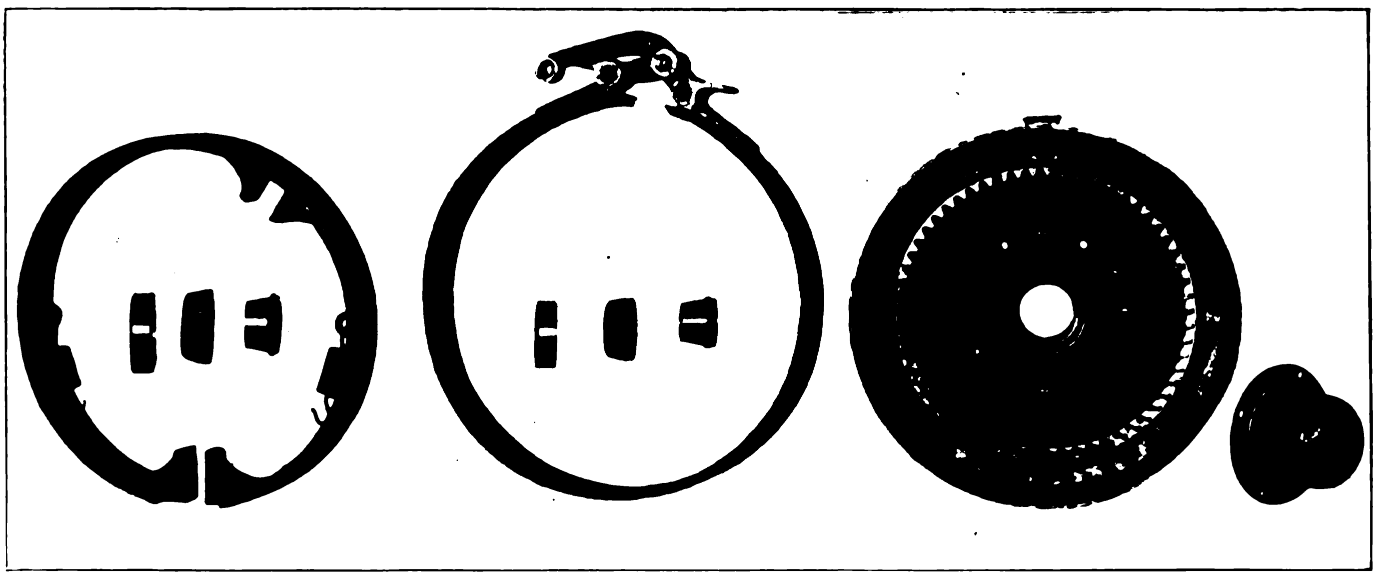
The Russel internal gears, made of special alloy steel, and perfectly hardened, will outwear the other moving parts of a truck. Engineers have estimated the life expectation of a set of Russel internal gears to be 200,000 miles, this estimate being based on calculation of results obtained by severe road tests of a truck equipped with a Russel axle. This machine was driven 12,000 miles, across the continent to the Pacific Coast, and back, and on its return to the factory where it was built it was disassembled and examined. No wear was visible on the internal gears despite the fact that these gears had been lubricated but twice during eight months, and for the last 4000 or 5000 miles had received no lubricant other than what had worked into the gear housing from the jackshaft. The pinions, which were hardened, had been reduced between 1/1000 and 2/1000 inch on the pitch line, while the large ring gears, which were not hardened, had been reduced from 4/1000 and 6/1000 on the same dimension.

These internal gears were among the first made, and since then an even better quality of steel is used and the methods of heat treating improved, so that both the pinions and ring gears are hardened before being installed in the axles. The life of the gears now used is reasonably expected to be twice what was estimated for the particular set that was the subject of the test described. Statement is made that a claim that these gears will outlast the other working parts of a truck is safe and conservative.

Load on Solid Forged Steel Bar.

The load carrying axle is a solid bar of forged steel, such as is used in locomotive construction. No argument is necessary to prove that such an integral steel bar of suitable dimension is ideal for an axle. Whenever other considerations do not preclude its use it is utilized for wagons and carriages, for railroad cars and locomotives, and for motor cars of all types, for front axles, it is standard. With reference to axle construction claim is made that few, even among experts, realize the enormous increase and intensity of axle stresses with solid rubber tires as against pneumatic tires. The pneumatic tire is a compressed air cushion in which obstacles are absorbed, so to speak, forming cavities for themselves in the surface of the tire. Formation of this cavity and its corresponding elevation on the inside of the tire wall increases the air pressure within the tire, and this increased pressure is instantly distributed throughout the air volume to every portion of the internal wall of the tire.

In the solid tire, however, the absorption of an ob-



The Russel Internal Gear Axle Brake: From Left to Right, the Internal Brake Shoe and Axle Bearing Disassembled; the External Brake Band and Axle Bearing, and the Brake Drum and Internal Gear and the Hub Cap.

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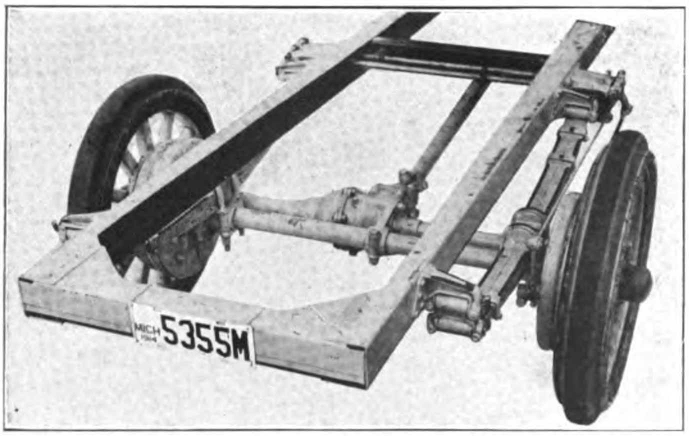


The Russel Internal Gear Axle Installed on a Truck Chassis, Showing the Light Weight and Simplicity of Assembly.

stacle displaces not air, but rubber, and the entire action is concentrated within a few inches of the place of contact. The action is far less resilient and the resulting shock reactions more violent. As solid tires age, the rubber loses life and becomes worn and thin, constantly increasing its rigidity and shock-communicating qualities. Indeed, a solid tire worn close to the rim flange has little, if any, greater cushioning effect than a steel tire. The axle structure composed of tube and castings secured by any mechanical means will be subjected to load and driving stresses such as will particularly affect the joints of the metal. The claim is made that no built-up axle structure, apart from the added uncertainty of steel castings, can ever approach the reliability of the solid one-piece forging without load-carrying joint.

Damage Can Be Quickly Repaired.

The steel bar axle is especially serviceable in resistance to fore and aft bending stresses and to twisting action. The advantage of the Hotchkiss drive, in which the driving axle is connected to the frame solely by properly proportioned side springs, materially changes the stresses to which axle rings are subjected as compared with older types of drive. With the Hotchkiss construction the breaking of a side spring throws twice the normal load on the unbroken end of the broken spring, giving a powerful twisting action or torque to the axle beam. The axle must have the strength to resist temporarily this unusual force, and the statement is made that the round bar is the ideal section to resist this character of stress.

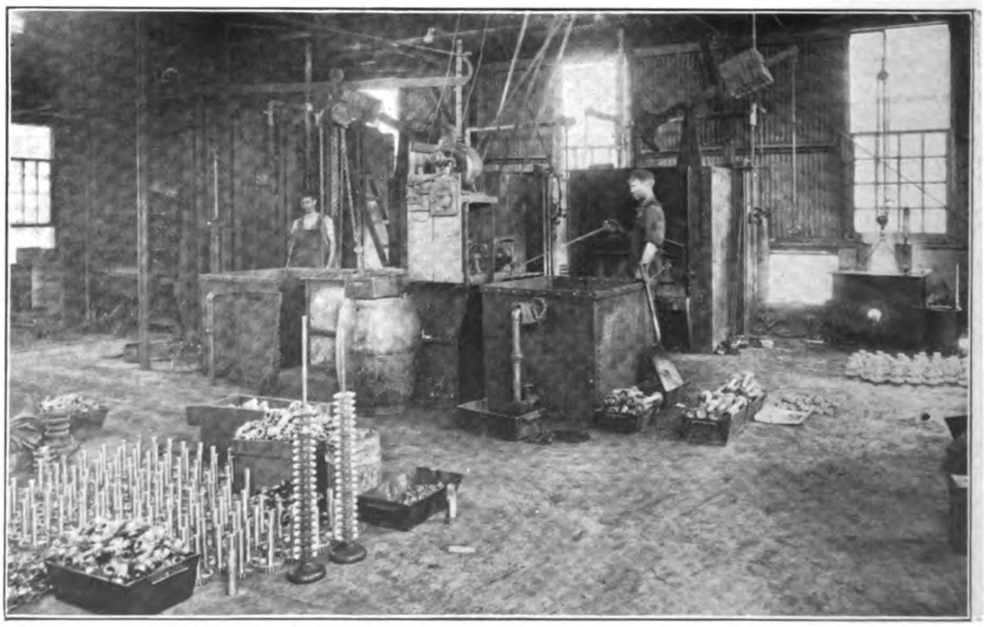
Axles are frequently sprung by the truck striking an obstruction, the axle end being bent forward. In the event of such damage with a Russel axle bar the round section can be swung in a lathe and trued with greater accuracy, an operation hardly possible with more complicated forgings. This was one of the reasons why the company selected a round bar for the axle carrying the load.

Brake Design Very Efficient.

Strong claims are made for the brake mechanism of the Russel axles. The Russel brake design has been developed from long experience with the manufacture of jackshafts for trucks. The internal gear axle brake drums have three-inch width of braking surface and are 16 inches diameter, for the ton type, and 18 inches diameter for the two-ton type. Because of the patented brake support, which eliminates all retaining clips for bands, and consequently suppresses noise, the retaining rim serves as a dust and mud shield, preventing foreign substances entering the brake drum and the gear case.

The capacity of either brake is greatly in excess of any service requirement, there being a very large factor of safety. The brake bands and shoes can be adjusted almost instantly. They are faced with antifriction material that insures high efficiency and long endurance without renewal. All braking stresses are borne by the solid bar of the axle and the jackshaft is protected against any influences other than that caused by the transmission of power from the engine.

The long experience of the Russel company in the manufacture of differential gears for motor truck jackshafts is a guarantee of the quietness and endurance of the differential assembly. The construction of the differential housing and mounting it ahead of the dead axle insures full ground clearance, a very desirable quality on country roads and in city streets when snow is deep. The simplicity of the Russel axle, the accessibility for examination or work, and the provisions for lubrication are all features to which the maker directs the particular attention of truck buyers.



The Heat Treating Department of the Russel Motor Axle Company's Plant, Where All Components Are Specially Tempered.

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DEMONSTRATION OF FARM TRACTORS.

To show nearly 50,000 corn belt farmers the perfection that has been reached by the gasoline tractor for farm work, 1000 acres of land were plowed by 30 or more different makes of tractors near Champaign, Ill., between Aug. 3 and 6.

Some of the companies showed three or more different sized outfits. One company in taking its tractors to the demonstration over the roads demonstrated them to farmers along the way. Another shipped 36 carloads of machines to Champaign, where it expected to sell them as a result of the demonstrations.

In connection with the demonstrations lectures on farm power were given at the University of Illinois in the evening by C. O. Reed, W. L. Burleson and I. W. Dickerson of the University of Illinois, F. M. White of Wisconsin University, and Raymond Olney, editor of the Threshermen's Review.

The visit of so many influential farmers gave the university authorities an opportunity to show them over the grounds, explaining every department of the work, particularly that having to do with agriculture, in order to explain what is done with the $5,000,000 a year appropriated by the state for the support of the university and the manner in which the 6000 students spend their time.

SKILLED LABOR SCARCE IN DETROIT.

Nearly all of the large Detroit plants are employing many more skilled machinists than they were at this time last year. Some of them have attempted to go out of town for men, especially to Milwaukee, but found it impossible to get men there, as there are plenty of jobs in that city. The Ford Motor Company is planning on the largest run in its history, during which it will turn out approximately 500,000 cars and will employ a large additional number of men.

NEW KISSELKAR DELIVERY WAGON.

As the first truck of less than 1500 pounds capacity, the new 1000-pound delivery wagon bearing the KisselKar mark is attracting a great deal of attention. This company has been making trucks for eight years, almost as long as it has manufactured passenger cars, but the overwhelming majority of them have been of heavy type. Worm has been substituted for chain drive on the one, 1½ and two-ton sizes.

The Detroit Pressed Steel Company is planning the erection of a new office addition 57 by 130 feet, and a one-story factory addition 57 by 185 feet, to cost approximately $25,000.

The M & S Gear Company has moved from Kansas City to Detroit. Its product is manufactured by the Brown-Lipe-Chapin Company of Syracuse, N. Y.

NEW S. A. E. DATA SHEETS.

Systematically Compiled Information of Value Added to Official Hand Book.

A number of new data sheets have been issued by the S. A. E. for insertion in the society's hand book. These sheets give the details of the most recently adopted standards of the society. These include the new yoke and rod end pin standards, large hex spark plug shell, large diameter thread pitches, standard sizes of pneumatic tires, recommended practise for passenger car frames, side outlet carburetor flanges, larger sized flared tube ells and tees and new specifications for ground return electrical installations on gasoline automobiles, all of which are described and illustrated clearly.

The N. A. C. C. formula for horsepower, previously the A. L. A. M. rating, has been extended to cover eight and 12-cylinder engines. Conversion tables from percentage of grade to angle of grade are also included. Piston displacement tables for eight and 12-cylinder engines from 137.4 to 1531.5 cubic inches are given as well. Two sheets are devoted to crank angles and corresponding piston positions. The effect of altitude on the horsepower development of gasoline engines is treated with curves and formulas. Diametral and circular pitch tables, which are useful to engineers in laying out transmissions and other gear work, are given on four sheets. To the metric conversion data previously issued, a table has been added giving decimals of a millimeter for each thousandth of an inch. This is the first time that all this information has been circulated generally.

There is a new standard of linear units, as well as a conversion curve of miles per gallon to litres per 100 kilometers, from which the engineer can determine the gasoline consumption in terms of the metric system. The sheets on the standardization of pipe thread gauges, total keyway depth, equivalent value of electrical, mechanical and heat units, and the economical selection of belts and pulleys make the hand book of greater value.

An exhaustive cross index of the two volumes, containing over 400 pages, has also been added. As the new standards now before the society for mail ballot are adopted more data sheets will be issued. The society also collects and prepares for publication other data than its adopted standards when they are of great interest to the automobile engineer and manufacturer. Proper credit is given to the original sources.

The S. A. E. hand book is one of the most valuable products of the society. It contains more data valuable in the automobile drafting room than any other publication, and this information is constantly being added to as activities of its technical committees advise.

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BUDLONG LEAVES PACKARD COMPANY.

Milton J. Budlong, for seven years president of the companies which operate the Packard Motor Car company's branches in New York, Philadelphia and Chicago, has resigned to become vice president of the importing and exporting firm of Gaston, Williams & Wigmore of 140 Broadway, New York City. This is an English concern that has heretofore largely dealt in English commodities, which it marketed throughout the world.


Milton J. Budlong, Retiring President of Packard Subsidiary Companies.

It recently came in contact with Mr. Budlong through the purchase of Packard trucks for the English market.

A knowledge of American products convinced the firm that there was an enormous market throughout the world which could be developed, and it has planned to operate on a large scale. Mr. Budlong is to be the American representative.

He will be succeeded in control of the New York and Philadelphia Packard branches by E. B. Jackson, former head of the Philadelphia company. H. M. Allison, for many years manager of the Chicago branch, will become president of that company. Great regret is expressed by Packard officials because of Mr. Budlong's retirement.

DRIGGS-SEABURY TAKES WAR ORDERS.

As a result of the refusal of its president to accept orders for any war material excepting motor trucks the Driggs-Seabury Ordinance Corporation of Sharon, Pa., has recently been sold to interests identified with the Bethlehem Steel Company and will be operated by E. A. Borie, a former vice president of that company.

Early in the year the company got an order for 3000 heavy motor trucks valued at $12,000,000. But President John Stevenson, Jr., refused to take any additional war orders of any sort in spite of heavy pressure from interests who had financed the company.

He made a statement saying that many orders had been received but all had been rejected. Although, he said, the company had been organized originally to build a field gun and had built a great many of them its policy had been changed and no war material would be manufactured.

The plant is completely equipped for the manufacture of shrapnel and high explosive shells and field guns. Recently it abandoned the production of ordinance and engaged in making frames and parts for automobiles and cycle-cars. Existing contracts for this material will be filled but no more will be accepted until the available war orders have been completed.

PARTS MEN FEAR INCREASING COSTS.

Uncertain conditions in the metal manufacturing industry are daily becoming more acute and many motor vehicle manufacturers are experiencing difficulty in closing yearly contracts for parts and material on terms that are satisfactory.

This uncertainty has been evident with several manufacturers. The Ford Motor Company in its annual announcement avoided making definite statement as to the amount of rebate to be given purchasers this year and in reality continued the net price for which Ford cars were sold the past year.

The Chalmers Motor Car Company, after fixing the price of its new "light six" at $1275 has announced that the car will sell for $1350. More of these announcements, both with reference to passenger cars and trucks, may follow.

The fact is that owing to the war and the great demand for tools, steel and all metals prices may reach very much higher prices than at present. The demand for an eight hour work day by union machinists is increasing labor cost.

The result is that parts makers are not anxious to make long time contracts on a basis of prices that now prevail because those prices may shortly fail to yield any profit whatever. There have been many predictions that manufacturers will not be able to produce anything like the number of machines some of them have planned for the ensuing year through inability to get parts and material.

NEED NOT SELL TO PRICE CUTTERS.

The first suit brought under the Clayton fair trade and anti-trust law brought a decision in the United States district court of New York to the effect that makers or jobbers need not sell their product to chain stores or others who cut the established price upon it.

This decision was made in a suit by the owner of a large chain of stores to force a manufacturer on whose goods he had cut prices to sell him additional goods. The court also held, however, that if the chain store owner succeeded in getting supplies of the goods in any way these could be sold at whatever price the retailer wished to make on them. This puts it up to the maker to see that his goods do not reach price cutters if he wishes to avoid price cutting. Great legal talent is enlisted on both sides of the controversy, which is to be carried to the supreme court.

BOSTON MOTOR MAIL DELIVERY.

Contracts for the transportation by motor car of the Boston mails has been let by Postmaster Murray to the Boston Mail Delivery Company for $49,960 a year. The company furnishes a bond of $70,000 and the contract runs until June 30, 1917. The service replaces one supplied by the Boston elevated lines.

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GASOLINE GOES UP IN PRICE.

Exceptionally low prices of gasoline which have prevailed for several months seem to be at an end. During the past few days advances have been general throughout the country. In Texas and Oklahoma, where the price has been lowest, around nine cents, an increase of four cents has been generally made, and as the attorneys generals of those states are investigating why the advances were made on the same day by all companies, a concerted inquiry is suspected.

In the East an increase of one cent a gallon in price has been general.

The Prairie Oil and Gas Company, a large Oklahoma producer of crude oil, which has had many thousands of barrels in storage for several months owing to the low prices, announces a raise in the price of crude of 10 cents a barrel. This amounts to more than $4,000,000 value on the reserve supplies of that one company.

There have been evidences of an over-production of both crude oil and gasoline in the United States and the unusually low prices which motor vehicle owners have recently enjoyed have been partly due to that. This condition has practically brought production to an end and only an increased price for crude oil will stimulate further development of the oil fields, in the opinion of those familiar with the oil industry.

JULY MOTOR VEHICLE PRODUCTION.

Traffic statistics of the National Automobile Chamber of Commerce show that 12,515 carloads were shipped in July, as compared with 4870 carloads in July last year. This is nearly a 300 per cent. increase and establishes a new record for this time of year. Railroads are earning about $1,000,000 a month on automobile traffic. During June 4713 motor vehicles were exported, with a value of $8,747,506, from the port of New York. This is about 7½ times the exports for June, 1914, and is more than equal to the best three months of any previous year.

The Shanghai Tramways Company has placed five trackless electric cars or 'buses in operation on one road in that city. The cars were tried out some time ago, but had to be withdrawn because of the condition of the roadways. The roads have been rebuilt with concrete foundations. If the line proves successful others will be established.

The White company is preparing to issue $3,000,000 in preferred stock. There is now $500,000 of preferred out and $2,440,000 of common. The present preferred is to be retired at 115 with accumulated dividends, and the new preferred, paying seven per cent., will be sold to stockholders.

"PUBLIC WANTS FACTS" SAYS PEIFFER.

That the public wants facts relative to the tires they buy is the opinion of W. F. Peiffer, general manager of the Miller Rubber Company, Akron, O., who maintains that the assertions of concerns that they are enormous producers and have more or less prestige because of proportions of plants is by no means as important as informing the tire consumers what they receive for the money they spend.

W. F. Peiffer, General Manager Miller Rubber Co.

The real reason why any motorist purchases a tire is the use that is believed can be realized from it and the better the purchasers understand what manufacturing processes mean the more carefully and more intelligently can purchases be made. Buyers can be depended upon to make selection in ratio of their knowledge and when they are spending the money they want what will afford them the largest measure of service, utility and economy.

The Miller policy is to "place all the cards on the table" and inform the motorists the reasons why Miller tires wear, one of which is the fact that in the curing process neither the fabric nor the rubber compound are subjected to temperatures that will destroy the natural wax and oil of the former or the resilency of the latter, insuring extreme strength, resistance to wear and long service. And the buyer benefits through having a tire that will endure.

Ralph H. Upson of the Goodyear Tire and Rubber Company and the winner of the international balloon trophy in a race that started in Paris in October, 1913, has been selected as a member of a special committee which is to co-operate with the naval advisory board on matters pertaining to the use of air craft in warfare. President F. A. Seiberling of the Goodyear company has also been elected a director of the American Society of Aeronautic Engineers, organized at the suggestion of Thomas A. Edison, to act with the naval advisory board.

The Hayes Wheel Company, Albion, Mich., which produces hubs for the wheels turned out by the Hayes Wheel Company of Jackson, Mich., is erecting a new plant in Albion, which will be ready for occupancy Sept. 1.

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The Motor Truck

Vol. VI. Pawtucket, R.I. September, 1915. No. 9

Trucks Conquer Wilderness

CONQUERING the wilderness with motor trucks, the phrase may appear to be commonplace enough in view of the generally inconsistent use of the English language, but if the statement is accepted at its fullest value and in its broadest sense, it adequately represents the subject of this article.

THE PROJECT.

Building a dam in the Ripogenous gorge, in the wilderness of northern Maine, to create the fourth largest storage reservoir in America, to conserve the water from Ripogenous, Chesuncook and Caribou lakes and the west branch of the Penobscot river for a very large paper manufacturing company.

THE PROBLEM.

Location, 50 miles from a railroad, accessible only by "tote" road through a wild and mountainous section, used by sportsmen and for hauling supplies on sledges to lumber camps. All machinery, material and supplies must be brought by rail to Kineo, on Moosehead lake, and transported across the lake and overland to the gorge.

Building a railroad would cost from $15,000 to $40,000 a mile and after the dam was completed would have no productiveness. Regarded as impossible.

Haulage by horses would necessitate building a private road 40 miles long at a cost of $250,000, and transportation equipment for the estimated freightage would cost practically as much more. Work can be carried on only six months of each year, in reality doubling the haulage cost if the animals were not disposed of at the end of the season's work.

THE SOLUTION.

Building a private road from Lily bay to Ripogenous gorge at cost of approximately $250,000, buying nine five-ton White trucks at cost of $45,000, operating them 16 hours a day, seven days a week, at an approximate cost of $1575 a week, as against an estimated cost of more than $4000 a week for horses that could do an equal haulage, saving in the initial transportation equipment expense and in the first season's operation practically the cost of the road. With an additional crew of drivers and helpers the trucks could be used

The Pier at Lily Bay, Moosehead Lake, Showing a Load of Cement Being Transferred from the Scow Boat to the Wharf and to the Truck at the Terminal of the Road to the Dam.

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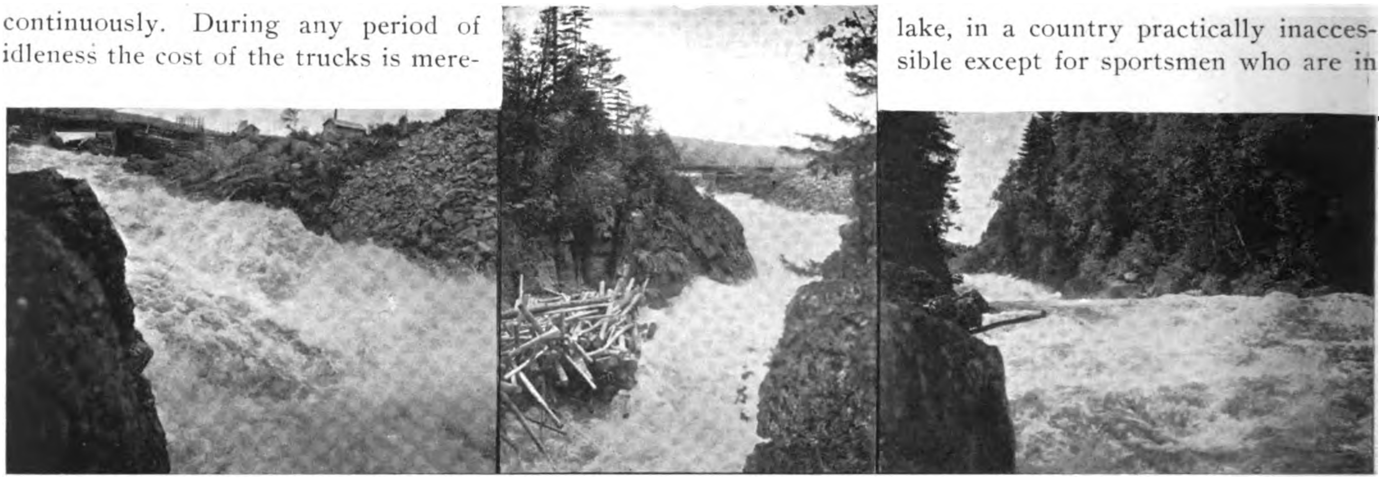
continuously. During any period of idleness the cost of the trucks is mere-



The Ripogenous Gorge Below the Dam Site: At Left, the Beginning of the Gorge; at Centre, the Rapids at Mid-Summer; at Right, the River Churned to Foam.

ly the pro rata of interest on investment, taxes and insurance.

This is a great engineering work, deep in the forest fastnesses of northern Maine, where the enormous natural resources are being amplified and controlled so that there shall be greater and more certain industrial activity for a long period of time—a work that could not be undertaken save at an expense that was practically prohibitive because of the difficulties of transportation, but which with motor trucks has been brought within the cost limit justified by the results that will be obtained.

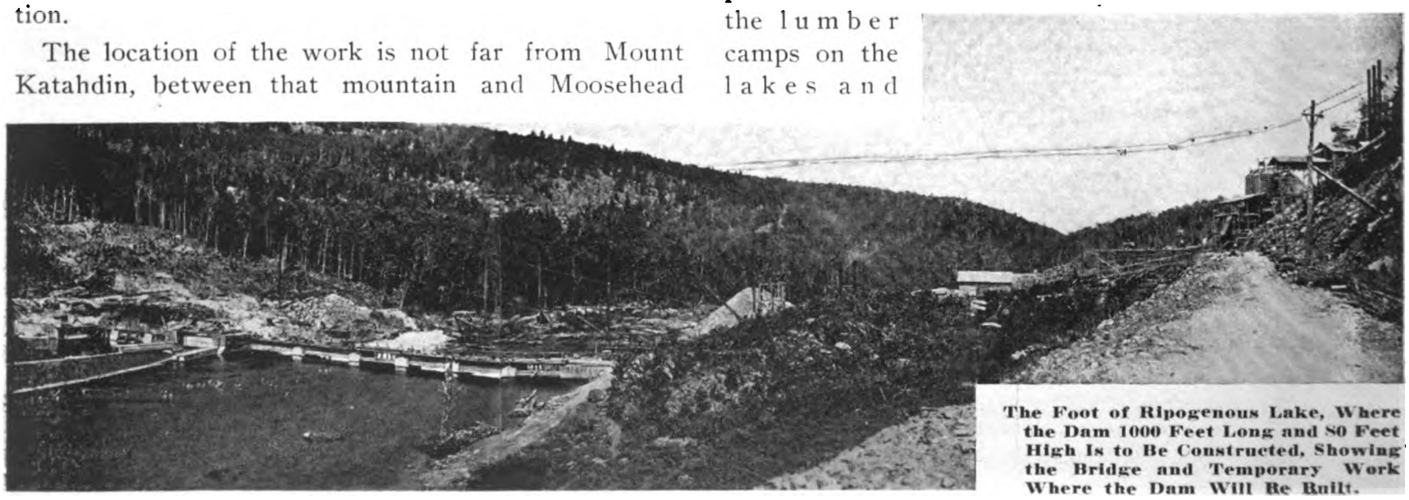
The project from an engineering viewpoint was possible and practical, but when the distance from existing bases of supply was considered and a great tonnage of material must be brought from these bases through a country that had, because of its forests, lakes and mountains, been abandoned by the pioneers of civilization, the character of the undertaking can be the better understood and the great cost realized. Although the need was becoming more and more pressing, this barrier of expense outweighed the economical possibilities until the engineers, by studying the utility of motor trucks decided that with them the transportation problem had been met and with carefully computed estimates the corporation, a great paper manufacturing concern, authorized the construction.

The location of the work is not far from Mount Katahdin, between that mountain and Moosehead lake, in a country practically inaccessible except for sportsmen who are in search of big game and fish, and in which some timber has been cut. The project is the construction of an enormous storage reservoir that will be 25 miles in length, which will contain when completed, 21,500,000,000 cubic feet of water, and will be the fourth largest in America. This reservoir will be created by the building of an immense dam in the Ripogenous gorge, and in it will be accumulated a large part of the flowage of what is known as the west branch of the Penobscot river.

Fifty Miles to Nearest Railroad.

This river is really a chain of lakes connected by streams of varying size, extending from the northwestern boundary of the state half way across it, and then flowing south to the Atlantic, these lakes being in a number of instances of large area. The river is navigable only with canoes, and along its banks for many years extensive lumbering operations have been carried on.

The nearest railroad is more than 50 miles away, and the distance to a highway that is accessible for motor vehicles is very nearly the same. By starting at Lily bay and following an old "tote" road, the most practical route to the gorge is 38.5 miles. This road was originally an Indian trail, that was later used by sportsmen to some extent, and over it was hauled on sledges, both winter and summer, some of the supplies used in the lumber camps on the lakes and



The Foot of Ripogenous Lake, Where the Dam 1000 Feet Long and 80 Feet High Is to Be Constructed, Showing the Bridge and Temporary Work Where the Dam Will Be Built.

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Below the Dam: At Left, the Construction Camp from the Bridge; at Right, the Bridge from the Construction Camp.

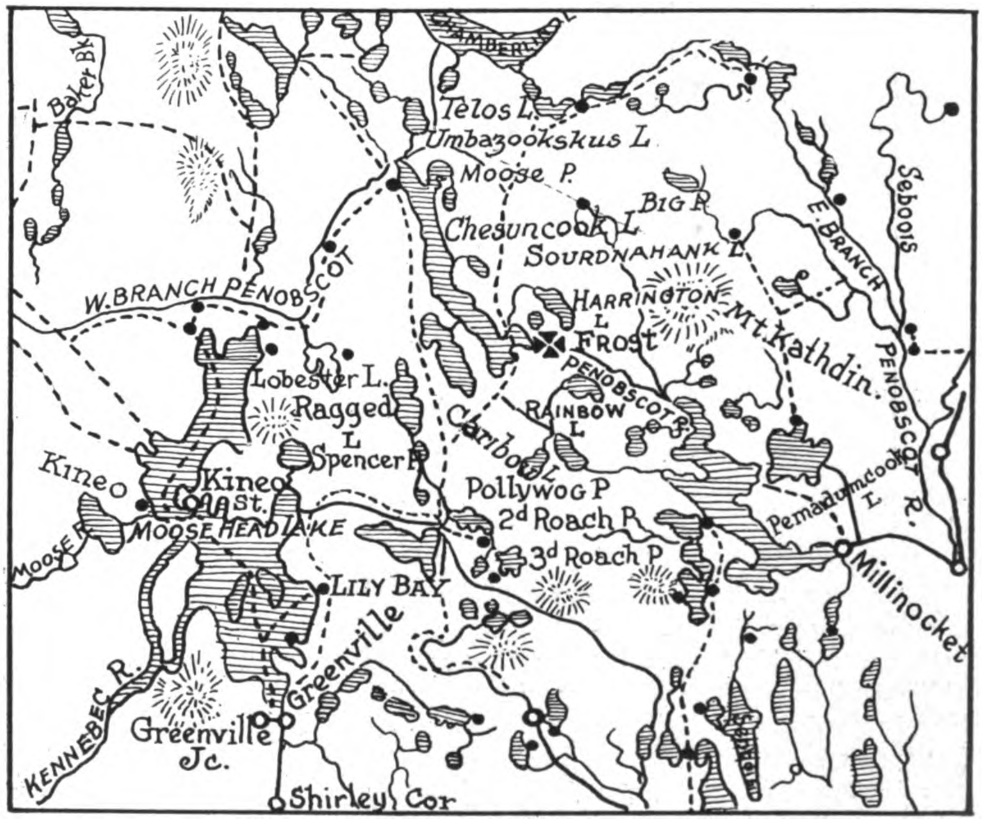
streams that constitute west branch of the Penobscot.

Moosehead lake is practically the headwaters of the Kennebec river, it being about 40 miles long and from 12 to 15 miles wide. On the west side, about 20 miles from either end, is Kineo, reached by a branch from the Canadian Pacific railroad, and at the south end is Greenville, which is the northern terminus of the highway to Skowhegan, and is also reached by railroad. On the east side of the lake, nearly east from Kineo, is Lily bay, where there is a small village. The railroad was built to Kineo because of the attractiveness of the noted summer hotel known as Mount Kineo, which is at the base of the mountain of that name, across the lake from Kineo. The north and east sides of the lake are encircled by hills and mountains north of Lily bay, and at the west of this ridge or range the flowage of the water shed is into Moosehead lake, and north and east of it into the west branch of the Penobscot.

In this section, north and east of the range, of which Mount Spencer is the highest peak, are a considerable number of lakes,. the largest ot which is Chesuncook. This is about 20 miles long and from one to three miles wide. With Mount Katahdin at the foot, this peak being directly north of Lake Pemadumcook, there is another range of hills and mountains extending nearly southeast and northwest, that is the divide between the water sheds of the east branch of the Penobscot river at the east and the Allagash river at the north. In this valley, which drains a large area of splendid timber land, is the water shed which the paper company controls, and the resources of which it is now developing.

Forests Supply Wood for Paper.

The forests of Maine have been drawn upon for lumber for centuries, the lumbering being done as near as is possible to the rivers and streams, down which the logs can be floated to the mills and the tidewater terminals. The large cuttings have been limited to the sections contiguous to the water ways, and along the large streams, including the Penobscot river, much timber has been cut, but the lumber that is distant from the water has not been felled. Ob-



Maltese Cross Shows Approximate Location of Dam at Outlet of Ripogenous Lake—All Material Is Shipped to Kineo, Ferried to Lily Bay and Hauled to the Dam—Dotted Line from Lily Bay Indicates "Tote" Road to Chesuncook and West Branch of Penobscot, in the Same General Direction Followed by the Truck Highway.

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viously the standing timber is increasing in value each year, but its cutting costs proportionately more. Though the forest is valuable for lumber, it is worth even more for another purpose—that of paper making, an industry that has assumed large proportions within recent years. The corporation, which is one of the largest concerns of the industry and has a number of mills in northern New England, converts the logs into wood pulp, from which various grades of paper are made.

The wood is usually cut in the winter, when it may be hauled on the snow and ice to the banks of streams, down which it is later floated to the mills. After high water the logs cannot be moved save at prohibitive cost. The water is highest in the spring from the melted snow and rain, and as a rule the flowage diminishes through the spring, summer and autumn, and in the event of minimum rain fall the lack of water is a serious problem for the paper makers. While high water is necessary to float the logs to the mills, so that transportation of the lumber is a matter of great importance, large quantities of water are necessary for paper manufacturing, for to be most profitable the mills must be operated 24 hours a day and seven days a week. This means that a uniform flowage of water is desirable and necessary, for while a condition such as would obtain with high water can be provided for by the location of the mills, low water may mean diminished production, if not suspension of manufacturing, and a consequent loss.

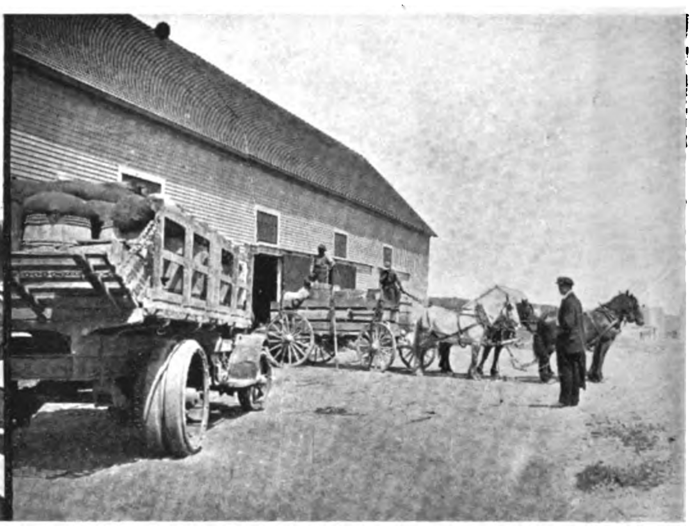
Conservation of Water Flow.

Water conservation cannot always be advantageously made when the water rights are shared with others, and individual control is always sought when such is possible, but having opportunity to protect itself and provide for the future so far as was possible, this paper company projected the construction of a reservoir that would insure a sufficient supply of water for a number of its mills, either now operated or planned. The site for this was located in the valley of the Penobscot and included the waters of Chesuncook, Caribou and Ripogenous lakes. Chesuncook and Ripogenous lakes are directly in the chain, the former north and the latter south, while Caribou lake is west of Chesuncook. The approach to Ripogenous lake from the river south is through a narrow gorge between two steep ridges, and at the head of this gorge the dam is now being constructed.

The reservoir was suggested and the river and the water shed carefully explored by engineers for a considerable period of time before legislative authority for the work was obtained in 1912, and an estimate of the cost was made. But the matter of transportation was to be dealt with. The nearest railroad terminal was 50 miles, and the construction of a railroad to the dam, while practical, was found to be prohibitive because of the cost and the fact that the road would have no investment value after the dam was built.

Railroad Cost Prohibitive.

The construction cost of a railroad would be from $15,000 to $40,000 a mile, and while this would be ideal means of communication, it could be operated only a part of the year, when operations could be carried on at the dam, and it would be idle during the winter and a part of the spring. Haulage of timber as compared with "driving" in the streams was out of the question, and there was no reason to believe that the country would be so developed that a railroad would have a substantial income in many years. If it were built at all it must be for construction purposes solely, and this outlay was too much for even one of the largest and most successful corporations of the kind in America to undertake.



Units of Transportation Equipment: At Left, a Four-Horse Team and Wagon; at Right, a Five-Ton White Truck and Load and a Horse Outfit and Freight.

There was the possibility of haulage by horse team over the old "tote" road from the nearest point on Moosehead lake to Kineo station, but the enormous tonnage and the limited capacity of animals meant high transportation cost. The distance by this road was about 40 miles, and a four-horse team and sledge could haul a comparatively small load, probably not much more than a ton unless in winter, when snow

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A Typical Truck Load Ready to Start from Lily Bay for the Trip to the Ripogenous Gorge.

haulage could be done, a period when the other work could not be carried on. Not only this, the number of teams required would be very large. All of the construction material, of which one item was 50,000 barrels of cement, weighing more than 10,000 tons; the steel, metal of different kinds, machinery, tools, food and supplies for the construction crew, food for the animals, and an unknown quantity of incidentals, would be taken into the forest from outside.

Big Ripogenous Gorge Dam.

Some idea of the undertaking may be gained from the fact that the dam is to be 1000 feet long, 80 feet high, built of cement concrete, and of a thickness to withstand the pressure of water in a reservoir 25 miles long, which would include the three lakes and the flowage from the river north and west of them. For two years the engineers of the company studied the problem. Figures of animal haulage were compiled and estimates carefully made, but the company delayed the work, hoping to find a greater transportation economy.

Finally the engineers made investigation of the possibilities with motor trucks, and having this information turned to the cost of building a road on which trucks could be operated to highest efficiency between Moosehead lake and Ripogenous gorge. This led to exploration and engineering data compilation and estimate was made that a highway suited for motor truck haulage could be constructed between the gorge and the lake for approximately $250,000. This road would have but one grade that would be a serious obstacle to traffic. This distance was 38.5 miles from Lily bay, and by using railroad facilities to Kineo, and by ferriage across the lake to Lily bay, a road could be made that would be practical, serve every purpose and have some influence in later development of the section through which it passed. The cost of the road was estimated at slightly more than $7000 a mile, the plan demanding a roadway of crushed stone wherever necessary, with high crown and side drainage ditches, of such width that there would be a sufficient room for one vehicle, and on which two might pass with care.

The engineers went into the project on the basis of tonnage capacity. They decided that a truck could make at least one round trip a day, or 77 miles, carrying five tons, against a team of four horses that could make two round trips a week, carrying 3½ ton loads, with a considerable reserve for the machines that might be made use of. The haulage of supplies must meet the requirements of the work, which would necessarily be rushed each open part of the year. The engineers estimated that with nine trucks, which could be worked as continuously as necessary, the transportation could be done. To equal this haulage capacity more than 100 four-horse teams and wagons would be required. The expense for the road would be practically the same if horses or trucks were used, but nine trucks would cost less than 25 per cent. of the amount required for animal equipment. This difference would pay for a large part of the initial cost of the road, and not only would there be no operating expense when the trucks were withdrawn because of weather conditions, but the animals would be practically as expensive when idle as when working. As the work was to extend over several years, the engineers believed that the annual saving on animal keep would at least make up the remainder of the cost of the road if trucks were bought.

Building the Long Private Road.

The work was authorized and the company's engineers prepared during the winter of 1913-14 to construct the road the following year. A fleet of scows was built for ferriage of trucks and animals across Moosehead lake and steamers for towage were obtained. Headquarters were established at Lily bay, and from that point the old "tote" road was gradually transformed last year by a gang of several hundred men who worked their way through the forest and over the mountains and hills, constructing a highway largely with a crushed stone surface that would be a credit to any community, although the surfacing of stone screening and rolling were dispensed with, the engineers depending upon the traffic to consolidate the roadway. What was wanted was a surface that would drain well, would be of sufficient depth to en-

Truck Ditched at the Roadside in Trying to Pass Another Machine on the Narrow Way.

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Starting the Big Descent, Where the Loaded Trucks Are Lowered a Quarter Mile by a Cable and Mechanical "Snubber."

dure under the traffic and withstand the disturbing influences of Maine winter weather, which prevails at least five months of the year.

The road building required all of last season, and there was considerable to be done this spring after the snow melted. When the highway was so far completed that its use the present year was assured the company authorized the purchase of equipment.

Training the Truck Drivers.

The engineers decided on the machines as carefully as they had all other details, and after close investigation an order was placed with the branch of the White Company at Boston for nine five-ton trucks, these to be fitted with stake platform bodies. The drivers of these machines must be men of intelligence and good judgment. They would have to be resourceful, for they would have to deal with unusual conditions, and the efficiency of the transportation would depend upon them. Training was necessary, and the men selected to drive the machines were sent to the Boston branch of the White Company, where they were given a very thorough course in practical motor truck care, repair and driving by Superintendent Coleman.

To have the men equally experienced with handling tires the drivers were taken into the truck tire department of the Boston branch of the B. F. Goodrich Company, where they were given instruction in installing and changing tires, making practical repairs and the like, for they would be dependent entirely upon themselves while at work.

Systematic Highway Maintenance.

The trucks were ready for delivery about the first of January, but they were not needed until well into the spring. Considerable work on the road was necessary. The road work had been done with horse teams and several hundred men were engaged in this work. To maintain the road to a standard that would insure economy a repair crew was organized and camps and tool houses were located at intervals with men assigned to the care of specified sections, to make inspection and repairs so that the trucks could be operated with positive safety day or night.

About the middle of May the trucks were placed in service. The work required was one round trip a day in 10 hours as a minimum, and 100 miles at least when possible, the drivers being paid a daily wage of $3, with a bonus of four cents for each mile driven in excess of 77. All of the supplies and materials are carried by rail to Kineo, where they are loaded on covered scows and towed to Lily bay. The freight of the boats is handled by conveyors that minimize loading and unloading the trucks. Frequently a truck is loaded in 10 minutes, so that idle time is reduced to a minimum. Unloading, when possible, is done by the same means.

Drivers Working 16 Hours Daily.

The wisdom of the use of trucks has been borne out in many ways. Because of the demand for material and for supplies for the hundreds of workmen at the dam the machines are now driven about 120 miles a day, working an average of 16 hours, and the drivers are earning $33.50 a week and their board and lodging at the company's camps. Not only this, the machines are worked seven days a week.

The trips from one end of the road to the other are made with as few stops as possible, generally being light from the dam to the lake, and carrying capacity loads returning. Care is taken that the trucks shall not be overloaded. The freights include everything that is needed for construction or used by the men. Surprising as this may appear, even the shingles for the buildings are hauled over the road by the trucks, which might seem like taking coals to Newcastle. The food for the small army of workers is considerable. So far as possible the lumber needed is made at the dam. Even the rails and cars for the industrial railroads were trucked over the road.

Road Has Many Grades.

Leaving Lily bay the road has a constant grade of about five per cent., on which the machines are driven at low speed, which affords a maximum of about five miles an hour. Two miles further on the divide between the water sheds of the Kennebec and the Penobscot rivers is reached, and then there is a

At the Foot of the Big Descent, Where the Wire Cable Is Cast Off and the Truck Can Be Driven Safely.

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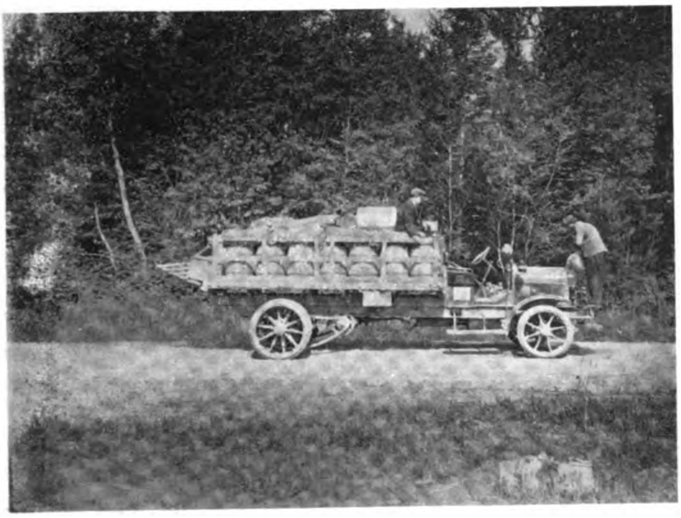

One of the Level Sections of the Road, Where the Construction Cost Was Minimum.

descent so steep that no vehicle can be safely driven down it. This grade is a quarter mile long, and all the trucks and such wagons as are used are, either loaded or light, lowered by a steel wire cable attached to a mechanical "snubber" that is operated by a single man. Returning with lighter loads or empty the trucks climb the grade in low speed ratios.

The remainder of the distance the road is winding with numerous short grades that will average about five per cent., these being so frequent that the drivers must use speed changes and emergency brakes. The surface of the road is fairly hard and is free from holes, water gullies and "thank y'r ma'ams," but the way is so narrow that ditching is not infrequent. Loaded, the trucks will average about 12 miles an hour, less than that speed when low gear ratios and as high as 15 miles on the descending grades when the road is clear. When light the machines are driven from 10 to 15 miles an hour, with probably faster time under favorable conditions on descents, while at night, when the way is more free, speed is practically to maximum. The mileage bonus is distinctly a stimulus to fast driving, but speed is absolutely necessary to do the work required. Not only is the day's mileage very large, but it is continuous, and there are no periods of truck idleness except when the drivers are sleeping.

Conditions for Truck Operation.

While the road is a fine example of highway engineering so far as obtaining a smooth and enduring surface is concerned, economy dictated that there should be no more work than was necessary, which accounts for the narrow roadway and the numerous grades on which low speed gear ratios must be used. Because of these grades the driving time between terminals is more than would ordinarily be required for a similar distance on equally good public ways.

The drivers do not always reach the ends of the road for night stops, and they obtain food and lodging at the camps that are maintained at intervals along the highway. When possible, however, they reach a terminal. The drivers, having been trained to make adjustments and ordinary repairs, care for the machines they drive, the trucks being supplied with unusually complete tool kits, while there is a machine and blacksmith shop at the dam, in which considerable work that might be impracticable in average operating conditions can be done. Because of the unusual demands made upon the men, about 16 hours' service a day to keep pace with the requirements at the dam for supplies, material and equipment, practically all the work on the machines until now has been done on the road, and during periods of loading and unloading and brief roadside stops.

The Economy of Truck Haulage.

Long distance haulage, with few stops, is decidedly the most favorable for motor trucks as compared with animal freightage, and the long hours worked is another very important factor in truck economy, for the physical capacity of horses is limited both by mileage and by load. The cost of a high-grade team of four horses, with harness, wagon and the necessary equipment, is not far from $2000. Such a team, worked to its capacity, can be driven two round trips a week, hauling 3.5 tons to the load, this requiring a mileage of 25.66 a day for six days. Such work, however, is more than animals could be expected to do constantly without relief. This is a tonnage of seven a week. In contrast with this the trucks make two round trips a day for seven days, carrying five-ton loads, or 70 tons for the same period—10 times as much as a single four-horse team. This is with reference to freightage.

Taking this as a basis, 90 four-horse teams and wagons would be required to do the haulage done by the nine trucks, but in addition to this, not considering the reserve of animals to have the 90 teams available at all times, for every eight teams another team would be needed to haul the food for the animals, or at least 11 more teams. On this basis 101 four-horse teams would be required, and with a reserve of 10 per cent. this would mean 450 horses at least to do the haulage. There would have to be 101 drivers, to say nothing of the stable help, and there would of

Filling a Radiator with Water at One of the Roadside Supply Stations—Note the Sharp Crown of the Highway Surface.

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necessity be large barns at both terminals and along the road.

High Horse Operating Expense.

The cost of horse equipment would be approximately $200,000, and 125 drivers and stable men would cost at $1 a day $125, or $875 a week. The cost of keeping the horses, with every necessary attention, would be $1 a day each, or $3150 a week, which would be a total of $4025 a week, this including interest, taxes, insurance, depreciation and the like, but as the working season is but little more than six months of the year, if the animals were kept through the winters they could do but little productive work practically a half of the time and the expense would not be much lessened during the period of inactivity. This would necessarily increase the cost during the working season. Considering these facts, the difficulty of reaching even an approximate cost of actual haulage with animals is apparent.

The cost of the nine trucks may be approximated as $45,000. The drivers average $33.50 a week, and each is accompanied by a helper. The shop equipment does not represent additional investment, as it would be necessary without the machines. The excessive mileage means increased operating expense, but the fixed charges are no greater. The depreciation can logically be doubled as compared with what is estimated for normal working conditions. Charging double for this item would appear to greatly increase the cost, but this, of course, ceases during the idle season. But including twice the average depreciation for the day or week while the trucks are worked, the total operating cost of the machines may be placed at $25 a day, or $175 a week, which is probably considerably in excess of the actual figures. For the full equipment this is a total of $1575 a week.

On the $250,000 Road: Upper Left, a Loaded Truck Making Time on a Level Stretch; Upper Right, Where the Grade Is Descending and the Truck Is Going Good; Lower Left, Down a Long Hill with a Full Freight; Lower Right, Near the Crest of the Long Climb, This Giving a Very Good Idea of the General Character of the Way.

Big Saving Will Pay for Road.

Compared with the estimate of $4025 a week for the horses this is a saving of approximately 60 per cent. On the basis of six months' work annually on the dam the saving in transportation would be about $60,000, and in four years, if this period is necessary, which would mean about two full years of continuous work, the saving of the trucks in operation expense would pay for the road, to say nothing of the original economy in equipment. There is another item of importance, and that is the cost of road maintenance. The effects of the traffic of more than 100 four-horse teams and wagons would undoubtedly be material.

This transportation work is extremely well systematized. The matter of loading was carefully studied to obtain the best results in weight distribution and insure against unnecessary mechanical stresses, and this also economizes in tires. The men are expected to drive consistently, and along the road are mileage signs that are made use of to practically operate the machines to a schedule. The trucks are worked now to what would hardly be regarded as practical with a single driver each, but with another set of drivers and helpers they could be driven a third trip each day if necessary. In fact, the longer the trucks are worked each day the greater is their productiveness.

Conquering the wilderness has been possible by the intelligent comparison of resources and facilities, accurate estimates of cost, and the scientific adaptation of methods. The project is extremely large and represents a great investment value, but nothing was unknown save the utility of the trucks, and the building of the special road not only made their use intensely practical, but has brought about a surprising economy, amounting in the aggregate to a very large sum.

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TAX THE TOURISTS.

New York Highway Commissioner Makes This Advice to Legislators.

The annual report of New York State Highway Commissioner John N. Carlisle for 1914, which has just been issued, characterizes the system of New York state highways as one of the greatest assets of the commonwealth.

In addition to the direct value of the roads to residents in the farmers hauling their products to market more cheaply and reducing the price of food to city dwellers, the roads attract every year about 250,000 cars from outside the state and these tourists spend millions of dollars there.

However, in his recommendation to the legislature, the commissioner advises that tourists be required to pay a share of the cost of maintaining the roads. The National Automobile Chamber of Commerce points out that the tourists are required to contribute heavily to the cost of constructing roads in their own states and that these roads are open without restriction to the use of motorists from New York.

New York state now stands first in the mileage of improved highways. It completed and accepted 863 miles of road last year and this year is completing 1148 miles, a large part of which is already open to traffic. Fully half of the whole system of 12,000 miles provided for by a $100,000,000 bond issue for state and county highways has been completed. The policy has been to construct only heavy, substantial roads in the vicinity of large cities—either brick or concrete, or roads with a concrete base. Where stone roads have been built they have been made very heavy. Half of last year's total of 863 miles was bituminous construction and 258 miles were water bound macadam. The maintenance of the bituminous and macadam roads is now one of the great problems of the department.

DEALERS BLAMED FOR CAR SHORTAGE.

Much of the present shortage in railway cars suitable for carrying automobiles and trucks has been caused by dealers, according to the traffic managers of a number of motor car companies, who are members of the National Automobile Chamber of Commerce, who maintain that these dealers do not unload their cars promptly, keeping them out of service on side tracks.

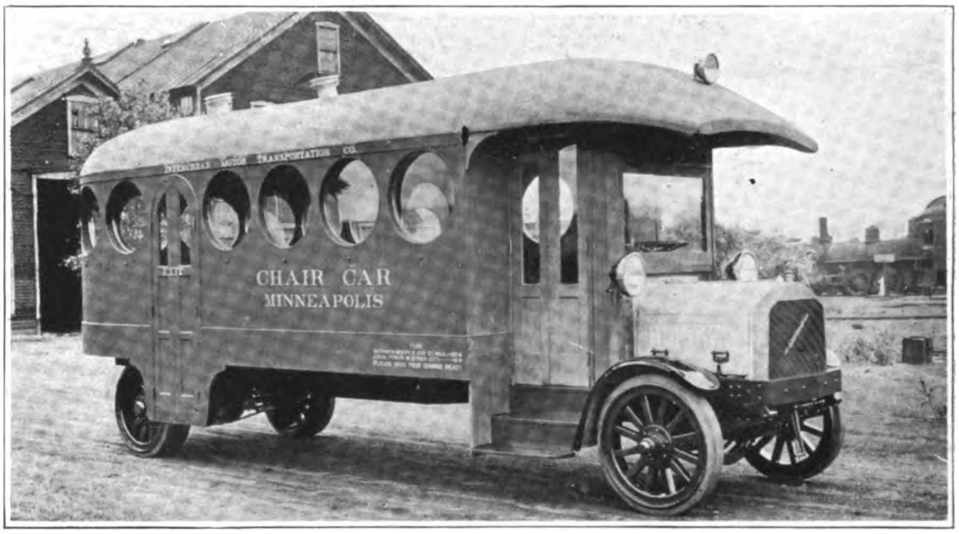
McKEEN HIGHWAY COACH.

New Design of Body That Has the Comforts of a Pullman.

What is new in highway transportation is the McKeen "highway coach," which is a body design that has the characteristics of the Pullman car and afford a degree of comfort for the passenger that has not been heretofore attained.

The chassis on which this body is installed is a standard production of the United Motor Truck Company of Grand Rapids, Mich., with an especially long wheelbase, the vehicle being 23 feet 10¾ inches length. It is built to the design of the regular 3½-ton truck chassis, save that the frame is larger and provision is made for supporting the especially long propeller shaft.

There are two propeller shafts. The first connects to the transmission gearset, which is in unit with the engine, through a universal joint. At the rear end of this shaft is another universal joint, which is supported by a rigid centre bearing. The rear shaft is coupled back of the centre bearing by a universal joint and to the rear axle through another universal joint, making four universal joints in all.



McKeen Highway Coach, a Special Type of Body for Passenger Service Installed on a United Truck Company's Chassis.

On this chassis is placed a body built by the McKeen Motor Car Company of Omaha, Neb. For 10 years this company has produced railway motor cars and the essential details of the body are the same as were developed for railroad service.

The body is fitted with individual chairs. These chairs are a new design with steel spiral spring pneumatic shock absorbing cushions which are patented. A two-foot spiral spring is used and each chair has four different air cushions, which serve as shock absorbers. On the road the comfort of these seats equals that of the heavy railway coach.

The ventilating, heating and sanitary arrangements of the highway coach are similar to those sup-

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plied in the gasoline railway car. Round plate glass windows afford an almost uninterrupted panoramic view in all directions. The windows when opened are hinged to the ceiling and there are circular openings 24½ inches diameter, which admits plenty of air during summer weather. Exhaust suction ventilators on the roof maintain constant circulation of air, keeping the interior of the coach free from foul atmosphere.

Entrance to the car is by a door near the driver's seat, so that he can supervise the prepayment fare collection. Passengers leave the car through a double-leaf outward folding door near the rear end at one side. The operating mechanism for both doors is handled by the driver.

The car is fully lighted by electricity and within easy reach of each seat is an electric button for signalling the driver when a stop is desired.

The passengers mount the car from the curb. There is no high step from the mud as in the case of a trolley car. The coach entrance is only 15 inches from

Interior of the McKeen Highway Coach, Showing the Unique Windows and the Individual Chairs for Passengers.

the ground, which leaves a step of seven inches from the curb. Passengers are taken from one side only—the right, which is always next to the sidewalk.

Heat from the exhaust of the gasoline engine serves to warm the car. Even in the coldest weather the engine produces a surplus of twice the heat units required to keep the interior warm so that ventilation insures plenty of warm, fresh air for the passengers at all times. This feature alone makes the coach very attractive to passengers as compared to a cold street car.

The interior of the body is luxuriously finished with a ceiling of white enamel and the inside trim is mahogany veneer with a deep coach carpet on the floor. The coach very much resembles a railway, save except that it is only about half as long.

A large number of orders for these coaches have been placed with the McKeen company and the probability is that the vehicles will soon be well known in interurban service in all parts of the country. Where interurban lines have not been built because of lack of capital or difficulty in getting franchises, this type of coach will solve the problem. The only things necessary to its successful operation are good roads and a sufficiently dense population to make the service profitable.

FEDERAL TRUCK RECORDS.

To meet the difficulty experienced by all truck salesmen in supplying customers with definite figures regarding the performance of trucks in regular service, the Federal Motor Truck Company, with the co-operation of its customers, has attached service records to a considerable number of machines and made exact records of the work done with them.

These service records give the speed, number of stops, length of stops and distances between stops made by the truck, and in connection with the amount of supplies used and material carried give exact data of the work done with the trucks. The record is made for a month for each truck and the results are then reduced to averages.

DUPLEX-POWER COMPANY'S DIRECTORS.

The annual meeting of the stockholders of the Duplex-Power Car Company of Charlotte, Mich., resulted in the election of the following board of directors: James H. Brown, W. H. Cooley, Horton H. Bryan, M. J. Lamson, A. M. White, Frank T. Town and Frank L. King. The executive officers were elected Sept. 8. An order for 200 trucks had been received from Denmark, according to the officers' report, but this was declined because the pressure of business was such that the company could not complete the order in the four months specified.

PACKARD BUSINESS NEARLY $16,000,000.

While the detailed report of the business done by the Packard Motor Car Company, Detroit, Mich., has not yet been made, it is known that the total volume of business for the year ending Aug. 31, 1915, was $15,800,000, as compared with $12,650,000 during 1914, an increase of $3,150,000, or about 25 per cent. The passenger car production fell off considerably, but the output of motor trucks was more than quadrupled, largely by European orders.

MOTOR TRUCK CLUB SEEKS MEMBERS.

The Motor Truck Club of New York, which has limited its membership to those not identified with the motor truck industry or trade is planning a campaign to increase its numerical strength among truck owners. A solicitor has been employed to interest business men in the organization and an effort will be made to obtain a large number of new members.

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PLAN FOR WAR EQUIPMENT.

Proposal to Have Industries Ready in Event of Nation's Need.

A plan for equipping the armies of the United States at the lowest cost and in the shortest possible time in event of war has been worked out by Martin J. Gillen, president of the Mitchell Wagon Company, Racine, Wis.

He proposes that the President appoint a general board of honor from among the business men of the country, and that each industry on which the government would have to rely appoint five representatives to a committee and that one of this committee be appointed to the honor board.

Specifications and quantities of materials needed should then be drawn by the army officers and submitted to the board. These specifications should be corrected with a view to producing types that could most easily and rapidly be made in American factories and which would still meet the army requirements. Necessary dies and jigs to make products meeting the specifications should be made at government expense and held in readiness for use.

The specifications should then be submitted to every manufacturer in every line and all should enter competitive bids on various quantities of equipment to be produced during the ensuing six months. The bids should be renewed every six months and kept up to date.

This, Mr. Gillen believes, would make it possbile to equip the armies in the shortest possible time at the lowest practical cost. It would avoid the difficulties into which the Allies have fallen.

Because manufacturers have been unfamiliar with specifications and were unable to figure costs of production accurately, almost double prices have been asked and given in many cases, Mr. Gillen says, for military supplies purchased in this country, and deliveries have been slow because tools and jigs were not available.

The Lavigne Gear Company of Racine, Wis., has changed its name to Lavine Gear Company. It has discontinued the manufacture of drag links and is concentrating on steering gears only. The company's business has increased 300 per cent. recently. Many new automatic machines have been installed, and more are on order for future delivery. The plant is working 22 hours a day.

ELECTRICS A BIG ECONOMY.

Jersey City Laundry Saves $600 a Month with 18 Wagons.

Exceptional results have been secured by Henry Sieminski, who operates the Brunswick laundry in Jersey City, N. J., with electric vehicles for package delivery. For three years this company has operated electric wagons and has gradually added to its fleet until 18 are now in use, besides three gasoline machines.

This company's first electric gave such excellent results that it decided, when necessary to increase its delivery equipment, to dispose of its horses and use nothing but this type of vehicle.

To have continued with horse drawn wagons would have meant an expenditure for stables alone of $18,000, not including the cost of the animals, wagons and harness. The 18 electrics now in use have not only done the work of the 40 horses which the company formerly owned, but have been equal to the demands of an exceptionally heavy increase in the business as well.

Fleet of 18 Electric Wagons That Show Marked Economy in the Service of the Brunswick Laundry, Jersey City, N. J.

Three stable men were required to care for the horses as against the one mechanic who keeps the trucks in operation, and this man takes care of the motors in the laundry as well. Mr. Sieminski realizes the importance of conserving energy and utilizing by-products and his system of correlating his delivery with the work of his plant throughout is very interesting.

As in most large laundries, where everything is operated by electricity, the Brunswick laundry generates its own power. The company found that the volume of water its apparatus would heat during the day was not sufficient for its needs, so it became necessary to heat water at night for the next day's washing. At the same time the batteries of the electrics are charged

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with current that is primarily generated for heating the tanks of water. Distilled water used in the alkaline-nickel-iron batteries is another by-product—the condensed steam of the hot water used for washing.

During the time water has been heated at night and current has been used for battery charging the coal bills for the plant have increased an average of $71 a month. As the company figures that the wages of the night mechanic is offset by the value of the hot water, the cost of operating the fleet of 18 electric machines, for adjustments, care and current, is estimated to be $71 a month. This is less than $4 a month for each wagon or about 16 cents a day.

Before the water heating necessitated the generation of current the cost of the electric energy was $10 a month a vehicle. As the electric machines averaged 20 miles a day the cost for current was practically two cents a mile.

Repair bills have been found to be almost negligible for the electrics. The company has paid $16 for repairs on the first wagon bought, which it has operated three years, and this expense was for new chains and sprockets. The concern is saving something like $600 a month by operating its electric wagons.

The initial price of the machines is large, but when the long life of the electric is considered—at least 10 years—the cost a year is very low. Mr. Sieminski considers the advertising value of the noiseless and neat looking electrics as worth considerably more than the interest on the investment.

The batteries used are the alkaline-nickel-iron type, and while these are guaranteed for four years by the manufacturers, the company counts on their lasting at least eight. Tires have been found to last from 1½ to two years.

The certainty of the service afforded by the electric wagons is such that the customers can depend on deliveries being made each week within 15 minutes of a given time and this is appreciated. The drivers are immaculately neat and this is attractive to women who might be skeptical of the efficiency of a laundry whose representatives look like blacksmiths or are noticeable from the odor of a stable.

The wagons are driven an average of from 25 to 32 miles a day with a maximum delivery of about 900 bundles a week. Driving 25 miles a day the current cost is about .6 cent a mile at $4 a month. On this basis and with a delivery of 900 bundles the current cost a bundle is about 1/100 cent. The wagons have proven their efficiency in snow and all kinds of weather. The same men who were driving the company's horses learned to drive electrics in a very short time. The machines are safe and seldom figure in collisions or accidents. The company is convinced that the electric is the best of all solutions of the laundry delivery problem.

An order has been issued for the distribution of a dividend of 38½ per cent., to the creditors of the Pope Manufacturing Company, Hartford, Conn.

PACKARD MAKES LARGE EXTENSIONS.

With 8200 men on its pay roll and an unprecedented volume of orders, the Packard Motor Car Company has begun large extensions to its Detroit plant. Additions that will increase the works by 400,000 feet of floor space are now nearly completed. The rush of orders for the Twin Six has been so great that the extensions made were doubled over the original plan. The buildings will cost $750,000 and will bring the total available floor space in the factory to 48 acres. Increased area is being added to the stamping department, forge, foundry, pattern shop, heat treatment building, truck assembly department, truck stock, service department and car finishing department. There is a new blacksmith shop 200 feet long, and a five-story steel and concrete building 400 feet long for the machining of chassis parts.

NEW 750-POUND DELIVERY WAGON.

A 750-pound delivery wagon that is sold for $690 complete is now built by the Detroit Commercial Car Company. It is a standard design with a four-cylinder block motor, with bore of 3½ inches and stroke of four inches in a unit power plant, and the drive is by shaft and bevel gear. It is fitted with pneumatic tires, cantilever springs in the rear and has wheelbase of 106 inches. Three styles of bodies are built as standard equipment. The tires are 30 by 3½ inches. The equipment includes a single-unit electric starting and lighting system. Deliveries are to be begun at once.

PITTSBURG FIRE APPARATUS HELD UP.

Refusal of the city controller to pay the American-La France Fire Engine Company, Elmira, N. Y., for about $87,000 worth of apparatus which has been built and delivered to the city, on the ground that the machines do not meet specifications in that they have not the power to afford satisfactory service on the steep hills of Pittsburg, has delayed the intended motorizing of the department. The city seeks to force the company to make alterations in the machines which will cost about $350 for each of the 11.

AUGUST CAR SHIPMENTS LARGE.

During the month of August nearly twice as many automobiles were shipped as during the corresponding month last year. The figures were 15,141, as compared with 8352 in August of 1914. This heavy exportation has caused a shortage of automobile cars owned by the railroads and the traffic committee of the National Automobile Chamber of Commerce has taken up with railroad managers the need of keeping these special type cars strictly for the use of the automobile industry.

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BUILDING A BUSINESS WITH MOTOR TRUCKS.

How the Independent Oil Company Extended Its Distribution from a Single City to the Greater Part of Southeastern Massachusetts in Three Years.

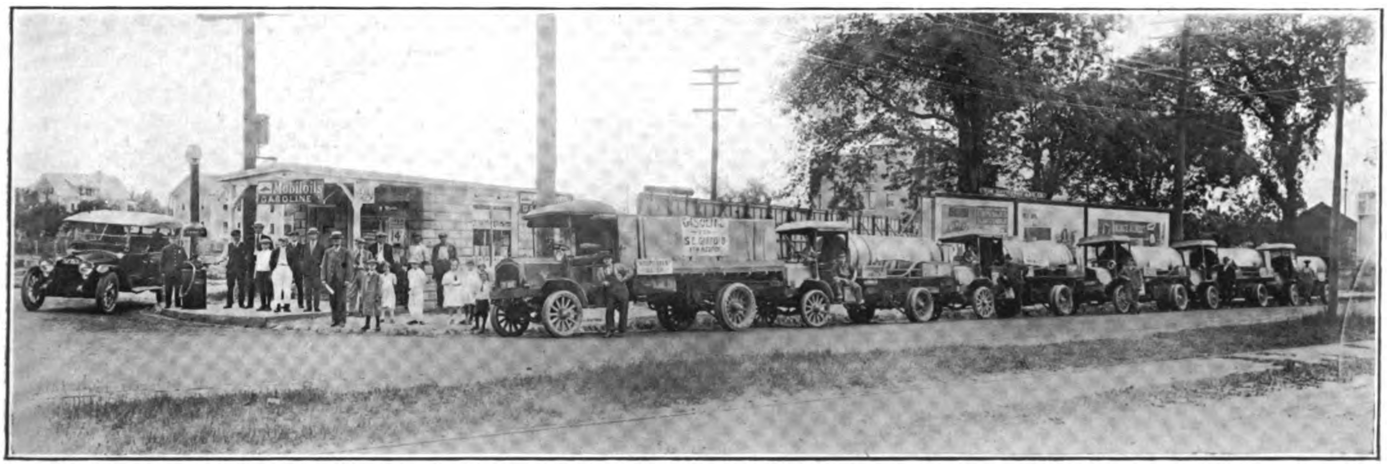
TRANSPORTATION economy from the viewpoint of the efficiency expert is saving of haulage cost, and estimates are usually based on existing conditions. These cannot be made with the intimate knowledge of the business man of commercial possibilities, which are largely dependent upon meeting the requirements of and serving one's customers. No better example of growth and expansion in keenest competition, made practical with motor trucks, can be found than the Independent Oil Company, Brockton, Mass., which distributes gasoline, kerosene and lubricating oils for automobile vehicles through southeastern Massachusetts outside of the Cape Cod section of the state.

Nine years ago the business was established by a man who had a horse and express wagon, and who was assisted by his son. The Standard Oil Company was at that time the only oil distributor in Brockton. The company had no special facilities for storage; the oil was obtained in barrels and generally sold in small quantities. Business was obtained by canvassing for customers. Success followed quickly and in two years the equipment had increased to seven single horse wagons with routes about the city and its suburbs. Then a piece of land was bought at Campello, beside the New Haven railroad tracks, on which was erected a small office building, and three 20,000 gallon storage tanks were installed.

The consumption for heating, cooking and illuminating purposes was comparatively small, but there was a very productive market among the rapidly increasing garages, public service stations and automobile owners who had their own garages. There had been a great increase in the number of motor vehicles in use, and besides this there was a splendid system of state highways which invited tourists from all sections of the country during the touring season. The main problem was to supply the motorists with fuel. The majority of the customers had no storage facilities and deliveries were necessarily frequent.

Market Covered a Wide Area.

At that time there were four cities in southeastern Massachusetts, Fall River, New Bedford, Taunton and Brockton, with many small towns and villages. Along the south shore, between Boston and Cape Cod, are many summer colonies. This entire section is mainly devoted to summer homes and country estates. Duxbury and Plymouth are respectively 25 and 30 miles southeast, 36 miles south is New Bedford, 33 miles southwest is Fall River, 18 miles west is Taunton, 14 miles northwest is Walpole, and 22 miles north is Boston, these distances being given from Brockton.

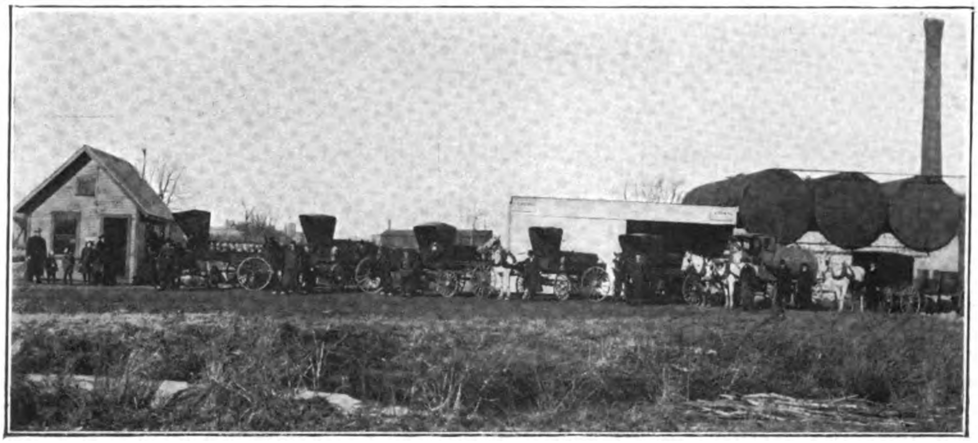


Six of the Fleet of Seven Packard Tank Trucks Delivering an Emergency Order of 6000 Gallons of Gasoline at New Bedford, 36 Miles Distant from the Main Plant at Brockton, Mass.

With horses the radius of distribution was comparatively small, but when a tank wagon was acquired a route was extended to Duxbury, the trip requiring two days and necessitating a night stop for the driver. But in making this trip there were two unproductive days for a team of horses, the one returning with the empty tank wagon and the other to rest the animals. Custom was easily established, but transportation was the greatest obstacle to expansion. Beyond the normal radius for horse haulage the cost of distribution rapidly increased, and separate stations would involve a considerable investment. The Brockton station was the logical place for placing capital, and concentration rather than scatteration appeared to be the wisest course.

Bought First Truck in 1912.

Five years ago a brother of the owner and the owner's son were admitted to the business and the cor-



The Storage Station of the Independent Oil Company, Brockton, Mass., and the Horse Equipment with Which It Made Local Distribution.

poration was formed. The company extended its operations gradually, but the possibilities were continually developing. Convinced of the necessity of serving a greater area, in 1912 two Packard three-ton chassis were purchased, which were delivered in September. These were equipped with 1000-gallon cylindrical tanks, with three dome manholes, each divided into three compartments, so that gasoline, kerosene and lubricating oil could be carried. The tanks were installed on the chassis by the company's men, the plan being to have this economy because the shop facilities were available.

One of these trucks was placed on the Duxbury route, which was then extended to Plymouth at the south, and another was used for the deliveries of large orders at a distance. Custom was developed in Taunton and within a radius of 25 miles, and lubricating oil was also specialized. The company found that the lubricating oil could best be distributed in five-gallon cans, this allowing the use of the tanks for gasoline and kerosene, and 100 gallons could be carried in cans on the platforms beside the tanks.

Trucks Much Increase Patronage.

With the trucks available patronage was found as far north as Boston, and as these customers took a tank load at a time and the haul could be made without stop in ordinary driving, this business was profitable, but no attempt was made to distribute in small quantities. In the spring of 1913 the plant was considerably increased in size, three additional 20,000-gallon tanks being installed in the yard, and custom similar to that at Boston was developed at Fall River and at New Bedford. The route along the south shore was so much increased that a station was located in Plymouth. This includes large storage tanks close to the New Haven road, where tank cars can be run on to a siding and the gasoline and oil pumped into the tank by an electric motor.

The Plymouth station did not do sufficient business to justify keeping a truck there at first, and so a tank wagon and horses were attached to this plant, which was in charge of a driver who established his own routes and developed the custom to best serve the needs of the different communities. At the different summer colonies, in addition to the garages and public service stations, there was found a large demand during the season from owners of motor boats and yachts, and from fishermen who used their craft practically the year through.

The business at Taunton was not neglected and a considerable number of large customers found there, and for this route the trucks were extremely economical as compared with horses, for a full load could be delivered and the round trip made in a half day. Next Fall River and New Bedford were exploited for large customers, who could dispose of considerable quantities, and frequent trips were necessary to these cities. A third truck was purchased in 1913 because of the number of customers at a distance to be served, and the number of horses used were lessened because of the greater mobility of the machines, which were efficient for all kinds of delivery.

The establishment of the station at Willimansett was the result of the removal of A. G. Spaulding & Brother from Stoughton, Mass., where a sporting goods factory was located. This company was a large buyer of gasoline and oil and when it decided to establish itself in Chicopee, Mass., the Independent Oil Company was informed that if it could supply it the arrangement then existing could be continued. The possibilities were considered and the company decided to continue the supply, for with this as a basis there was belief that additional customers could be found. When the factory was removed the Independent Oil Company installed a tank at Willimansett and sent one of its tank wagons and several horses there, with a man to take charge of the work.

At this station the equipment is much the same as at Plymouth, and the driver devotes whatever time is possible to developing the business and supplying the customers, receiving the oils and handling them both at the plant and when they are delivered.

Truck Equipment Increased to Five.

In 1914 the equipment was increased by the purchase of two more trucks. Like the first three, these were three-ton chassis, but on these were installed a different type of 1000-gallon tank. With the acquisition of these machines the company disposed of several horse teams and wagons. The business at Plymouth, New Bedford and Fall River considerably increased, a truck being used to make distribution to some parts of the Plymouth section that could not be advantageously reached by the tank wagon, but all the deliveries at New Bedford and Fall River were by truck.

The service of the five trucks very thoroughly established the company in the section of the state that

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it now covers. That is, deliveries could be made wherever desired, in practically any reasonable quantity. During the year the company built its office building at Campello equipment was installed there for supplying gasoline and oils at retail.

Two More Trucks This Year.

The sales had reached such proportions by the end of the year that plans were made for still greater expansion of the equipment in 1915, and during the spring two more worm driven three-ton Packard chassis were purchased and the last of the horse equipment attached to the Brockton plant was disposed of. One of the trucks was located at Plymouth, where a tank wagon and three horses are kept, and at Willimansett there is a similar horse outfit and animals. All of the deliveries from the Brockton station were made by tank trucks.

The present season the business at New Bedford and Fall River has increased greatly. Much of the time two trucks are used to supply the Fall River customers, and at New Bedford the sales are very heavy, one customer alone taking as high as 10,000 gallons a week. When one truck was driven twice a day to Fall River with a load the station in that city was decided on, and that was in readiness for use about June 1. This has two 20,000-gallon tanks, and one truck is attached to this station. The first Packard chain driven truck was exchanged for a new four-ton worm driven machine, on which was installed a 1200-gallon tank. This gives the company seven trucks, six three-ton and one four-ton, six with 1000-gallon tanks and one with a 1200-gallon tank, and the two tank wagons, the one at Plymouth and the other at Willimansett.

Handling the Oils Economically.

Handling the oils economically, both from the viewpoint of preventing shrinkage and of saving the time of the trucks in loading, has been carefully studied. At the Campello station the products are brought to the yard in tank cars that are placed on a siding on the railroad bed above the storage tanks. The oils flow by gravity from the cars to the tanks. Usually the car tanks contain from 8000 to 10.000 gallons. Several tanks may be discharged at the same time. The yard storage tanks are elevated on cement block cradles to such a height that the truck tanks can be filled by gravity discharge, and with a two-inch stream the loading is quickly done.

At Plymouth and Fall River the storage tanks are elevated above the ground to obtain the same loading condition, and for this reason the oils are pumped from the tank cars by pumps driven by electric current. The electric equipment is much better and safer than any other type, and power is not only instantly available, but attendance is limited to starting and stopping, and there is practically no cost save when the pumps are used. Lubricating oil is handled in five-gallon cans. The truck tanks are in three compartments, but two of these are usually used for gasoline and one for kerosene, although the proportions of the loads are some times varied from this.

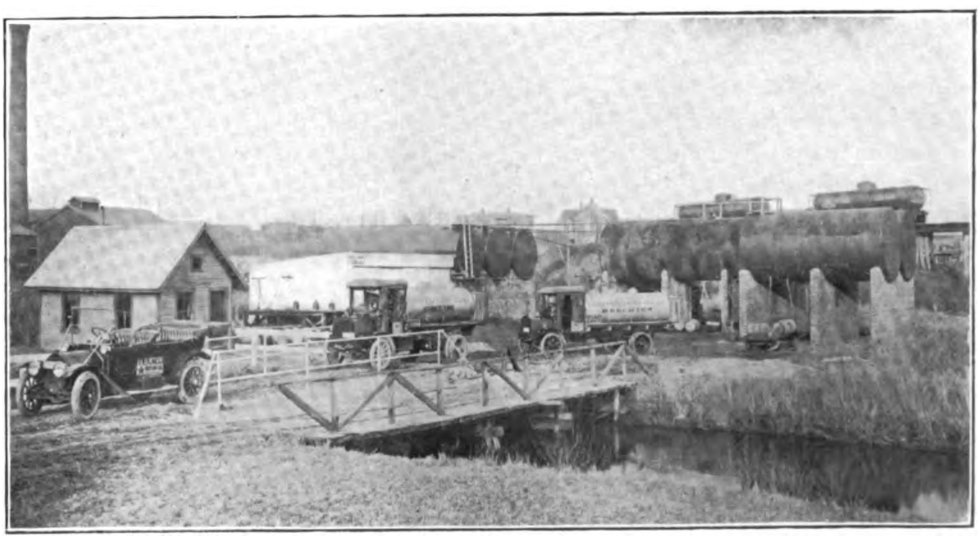
Records of the Stations.

The men in charge of the stations usually make up their own routes for delivery and they send daily reports covering the oils received, oils distributed, the number of customers, the stock on hand and the requirements, as well as financial statements, with reference to the business. Those having trucks also submit daily statements as to the work done with the machines and the consumption of fuel and lubricating oil and grease, the mileage driven, the condition of the tires, the attention given, and whatever is necessary in the way of vehicle maintenance. Much care is taken to preserve an accurate mileage record, which has bearing on the adjustment of guarantees and the eventual cost of tires.

The normal monthly mileage is approximately 1000, this being an average of about 40 miles a day for each working day, but this is slightly exceeded, for this average includes practically every working day and does not allow the time that may be taken for repairs, overhauls, etc. One of the machines was driven more than 2000 miles a month this spring and early summer, it making two round trips a day between Brockton and Fall River, but this mileage is not necessay with the station in the last named city.

Annual Mileage Exceeds 12,000.

The Packard truck exchanged for the worm driven machine had a mileage of slightly more than 38,000 miles in about 34 months, which is a very fair representation of the service obtained. There is no probability that this work will be lessened, and it may be increased



The Storage Station After the Increase in Tanks in 1913, and the Two First Packard Trucks with Which Expansion Was Begun.

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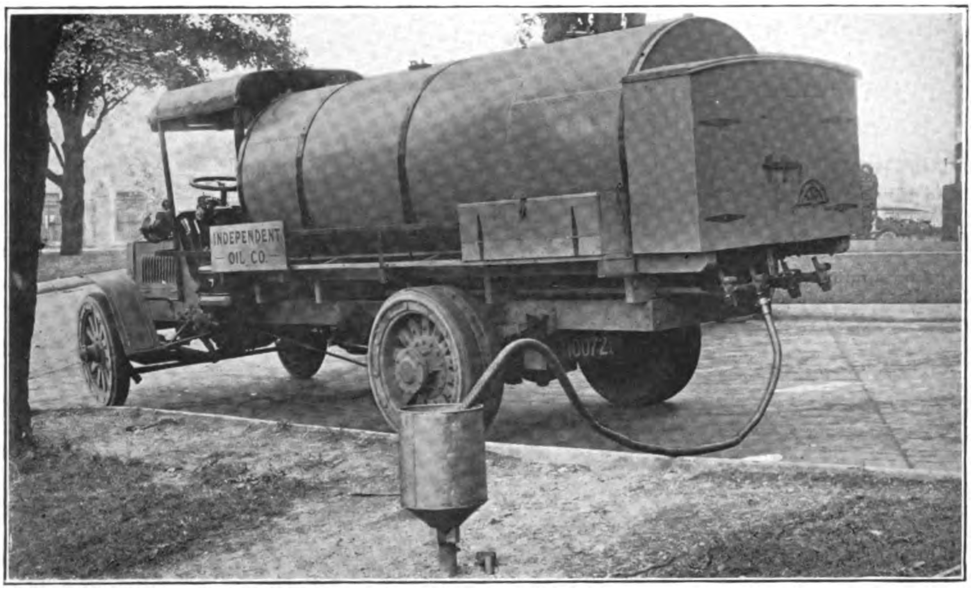
somewhat with future expansion. The long runs are generally with full load, the tanks being empty returning. Because of the character of the equipment return freights are impracticable, rather more than 50 per cent. of the mileage being unproductive.

The economy of the trucks is best obtained by careful routing, this being done each day and the drivers are given whatever additional haulage is practical outside of the regular routes served. All routes are planned with a view of giving the drivers time for developing new customers, and each truck serving a route takes out some excess stock to supply emergency demands. The sale of gasoline is extremely variable. One New Bedford customer who sells more than 10,000 gallons a week can only be supplied with 10 round trips to that city, and occasionally this stock is not sufficient. Whenever necessary additional trips are made, and sometimes large orders are delivered.

One of the accompanying illustrations shows six trucks on arrival at New Bedford with a special order of 6000 gallons of gasoline, this delivery being possible because the day was Sunday. The supply in the 10,000 tank of the customer was so low and the demand so great that the day was practically given over and the entire equipment used to bring the stock of this customer up to a condition that would insure him uninterrupted business. This circumstance well illustrates the enormous quantity of gasoline necessary to operate myriad of motor vehicles that are constantly in service.



One of the Latest Type Worm Driven Packard Trucks of the Fleet of Seven Now in Service, Delivering Gasoline at the Packard Service Station, Boston.

The drivers report at the Brockton yard at 7, and they are expected to leave as soon as possible, but no definite time of departure is fixed because the men have so much work to do, and each must complete his route, and whatever additional is assigned during the day. Each man's schedule is handed him and his route is designated for the day. From time to time additional long trips are made, but not as extra work. The overtime is usually emergency deliveries. A small pleasure car chassis has been fitted with an express body that will take a dozen five-gallon cans, and this machine is used to supply customers who urgently require gasoline, which is the occasion of practically all the special trips. This vehicle is occasionally kept busy for a whole day delivering special orders, and statement is made that it has long since earned its cost in this work. Satisfaction of the customers is necessary, and attention and accommodation has been the main reason for the development of the company's business to its present proportions.

Drivers Taken from Horse Wagons.

The company trained drivers of the horse wagons to drive the trucks, and they have been found to be very capable men. The men were taught to drive and to make minor adjustments and give the attention normally required, but until recently all repair work was done at the Boston service station of the Packard company. A short time ago the company established a repair shop in its garage, which it is now fitting with machinery and tools. This has been placed in charge of an expert mechanic whose work is to keep the trucks in operative condition. The expectation is that with this facility the company will reduce its maintenance and upkeep to lowest cost, and will obtain high efficiency. Unless in the event of an unusual condition there will be no need of sending the machines to Boston. Besides caring for the five trucks at Brockton, the mechanic is expected to go to Fall River and Plymouth whenever his services are required, or, if need be, the machines are brought to Brockton for whatever work may be necessary.

The machines are not overloaded, they are not driven at excessive speed, and the average work is approximately what would be triple the mileage of a horse team. They are worked continuously, and during the winter months the long trips are at times difficult. One haul from Brockton to Taunton during the blizzard of April 4, 1915, required 14 hours on the road, but that was an exceptional storm, for all traffic and railroads were obstructed. The chief purpose was to serve the customers and the load was delivered. This was an extremely creditable illustration of service.

Drivers Make Daily Report.

The drivers make daily report of the truck, giving their own and the helpers' names, the quantities of gasoline by gallons and oil by quarts used during the day, with any miscellaneous supplies obtained. The odometer reading for the day is noted, as well as the odometer reading when the crank and gear cases were

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last drained and filled, so that there can be no possible error. The drivers are warned by the report blank that the crank case, transmission gearset and differential cases must be drained, flushed and refilled every 1000 miles, and that there can be no uncertainty the odometer readings are taken and totalled by the drivers. The drivers are required to fill all oil cups each morning, to keep the grease cups filled and turn them each morning, to fill the tanks, and give regular attention before the work for the day is begun. A great deal of weight is placed upon mileage and odometer records for insuring thorough lubrication and for accurate accounting of tire service.

What is regarded as extremely necessary equipment are spare odometers for use in the event of accident, and no machine is started for work unless its distance indicator is in operative condition. The records are carefully kept and there is precise knowledge of work done.

Comparison with any other form of distribution is hardly possible, because the real value of the trucks has been manifested in the very large development of the business. The two stations would never have been established had not the custom been created through the use of motor trucks, and the large area covered, nearly 60 miles in one direction, and about 35 in another, could not be served with animal equipment. Use of horses would not be practical unless a number of stations were located, and even with these the Brockton experience has proven the animals are not as efficient or as economical as the machines. What may be regarded as a complete translation of equipment, representing a large investment, has been justified by the vastly increased market, and there is probability that another truck for Fall River and a station in New Bedford will be the next step in expansion.

PLOW AT NIGHT IN KANSAS.

Statement is made that 50 gasoline farm tractors have been purchased by farmers in Peabody county, Kansas, during the past few weeks, and that many of the machines are equipped with strong headlights, so that they can be operated night and day, work necessitated by delay of plowing by prolonged periods of wet weather. Kansas wheat growers declare that they could not have done the usual fall plowing this year if they had been limited to the work that could be done with horses.

DELIVERY COMPANY UNSUCCESSFUL.

The Merchants' Auto Delivery Company of Galesburg, Ill., discontinued its business Sept. 1. It was organized a year ago last May to care for the parcel delivery of the various stores in Galesburg, but it was not a financial success. The motor equipment of the concern is to be sold, probably to Marshall, Field & Co. of Chicago, if report is to be accepted.

SALES ON TIME PAYMENTS.

Indications That This Method of Selling Will Be Approved by Industry.

The experience of manufacturers of pianos, talking machines and other similar lines, which have always been eventually resorted to some time payment system to enlarge their market to its limit, has often been pointed to by automobile sales directors as an indication that such a system would eventually have to be adopted by motor vehicle makers.

During the past two or three years the motor vehicle business has been developing much closer systems of merchandising, both as to the reduction of overhead expense and the expansion of the market to its limits. This has led to further consideration of the time payment plan, and there are indications that this system is to be adopted by a number of leading makers on a scale that has never before been attempted.

In the past there has been time selling on the part of dealers, but manufacturers have not engaged in it and have ignored its adoption by their representatives.

One drawback to the system as handled by the dealers has been the inability of the dealer, through lack of satisfactory financial connections, to dispose of the customers' paper on advantageous terms, and the fact that few dealers had capital enough to carry it themselves. The high cost of discounting the paper has made the deferred payment prices too high to satisfy their customers and the dealers have often lost money by failure to safeguard themselves.

Some of the larger manufacturers of both truck and passenger cars are making arrangements either to have this paper taken on satisfactory terms by banking interests or by financing companies organized by the manufacturers themselves.

There has been developing in rural banking circles acute opposition to the sale of motor cars on the strictly cash basis, on the ground that it takes vast amounts of money out of the small communities. Sales of farm implements have always been made on the time payment plan and have given rise to a large amount of paper which has been discounted at the banks. As farmers are accustomed to that mode of payment, it is probable that a great many of them would prefer it, and its establishment would likely also lessen the growing opposition of the bankers to the motor vehicle business.

TRUCK TAXES IN MASSACHUSETTS.

The highway commission of Massachusetts is said to believe that owing to the damage they do to the roads motor trucks should be taxed more heavily than they are and it is likely that the legislature which will meet in Boston next January will be asked to pass new legislation imposing heavier taxes.

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FOUR-WHEEL DRIVE LABOR DAY.

Truck Company Furnished the Features of Holiday Celebration at Clintonville.

The Four-Wheel Drive Motor Company of Clintonville, Wis., achieved great local popularity with the people of that town when on Labor Day it entered $450,000 worth of four-wheel drive trucks in the parade with which the citizens celebrated the holiday and took a prominent part in other features of the festivities.

The trucks were a big shipment that was just ready to leave the factory—perhaps one of the largest shipments that has been made by an American truck manufacturer, notwithstanding the large scale on which trucks have been built since the European war was begun.

Thousands of the townspeople were given free rides on the trucks, men and women crowding all the available space of the platforms. The accompanying illustrations shows how three trucks appeared in the parade.

The day was also celebrated by a big barbecue at which two oxen were roasted and served to the hungry crowd. Several bands supplied the music and there was a great variety of other entertainment.

One of the big features of the day was a special demonstration of the power and capacity of four-wheel drive trucks. They were tested on grades of varying percentages and on roads which could not be traversed by machines driven with two wheels.

One exceptional test was made when a truck hauling a heavily laden trailer loaded with lumber was run into the river in an exhibition of fording. The truck went as far as it could hold traction and then a special winch, with which some four-wheel drive trucks are equipped, was utilized to extricate the machine.

These winches are mounted on the front ends of the trucks and are operated by the power of the truck motors. A cable from the winch of the truck being tested was run out to a post 200 feet away and the winch started. The truck with its heavy trailer went steadily ahead and climbed the steep, slippery bank of the stream, where it was impossible to get traction for the driving wheels. The winch was suggested by the army engineers of one of the belligerent countries for use in pulling trucks over roads or through fields where the ground is so soft that the wheels cannot find traction.

The demonstration ended with the truck pulling itself over a great pile of lumber. In the evening the new addition to the four-wheel drive factory was turned over to the crowd for a big dance in which more than 2000 people participated.

The home folk greatly enjoyed the hospitality of the Four-Wheel Drive Company and hundreds were entertained who came to town from miles around.

Some of the Four-Wheel Drive Trucks in the Labor Day Parade and Demonstration That Was a Feature of the Clintonville, Wis., Celebration.

S. A. E. OPENS FALL MEETINGS.

The various sections of the Society of Automobile Engineers begun their fall meetings in September, most of them having suspended activity during the summer. Both the Metropolitan and Detroit sections held their first meetings of the year Sept. 16. The New York section met at the house of the Automobile Club of America to hear a paper by Leon Goldmerstein on aeroplanes and the report of the research committee on governors.

In Detroit at the Pontchartrain hotel, J. G. Vincent read a paper on "The Twin Six Motor." The Indiana section met at the Claypool hotel Sept. 24 and heard a paper by J. G. Vincent dealing with modern tendencies in motor design, which again dealt specifically with the Twin Six motor. James E. Diamond also discussed aluminum pistons.

CUT NEW YORK INSURANCE RATES.

Rates for automobile insurance in New York City are higher than in the country districts surrounding, and it is said that many insurance brokers to break their rate have been writing insurance in which the addresses of New York companies are incorrectly stated.

Some companies are also said to attach the greater New York residence warranty to the policies in the usual form and then to waive them in a letter to the customer. The insurance exchange has interested itself in this situation and has asked various insurance companies what their practise is in this regard and what steps they take to make sure that addresses given outside the city are the correct addresses of those who are insured.

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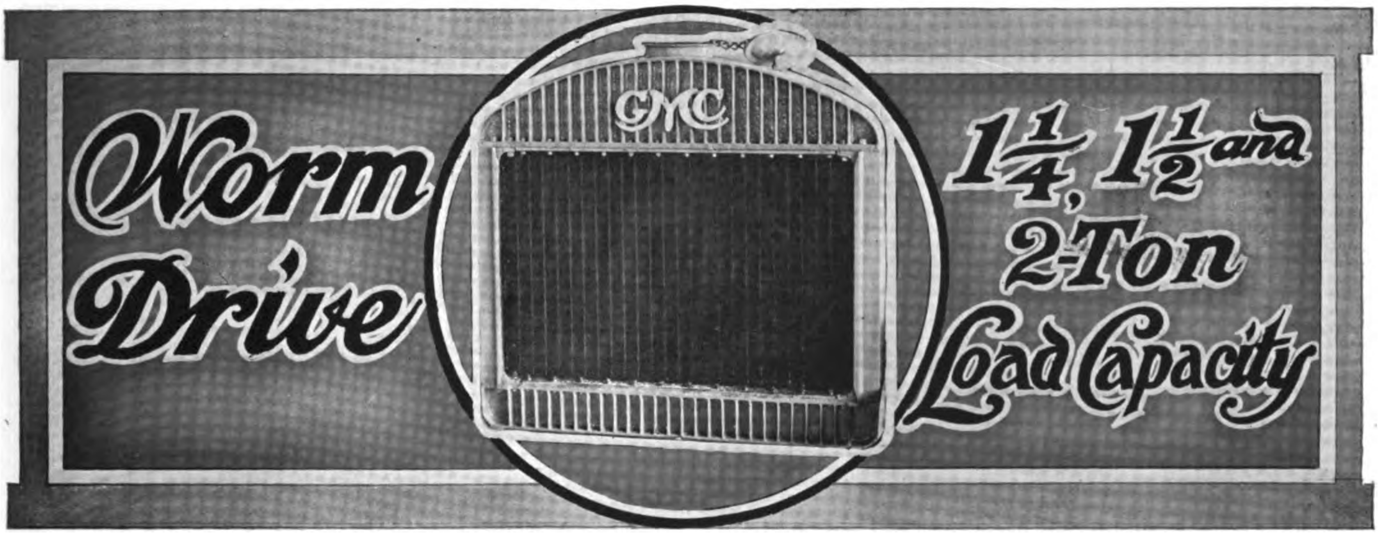

STANDARDIZATION has been sought by the General Motors Truck Company in the design of the worm driven trucks it has produced, and thus far these machines will be built in 2500, 3000 and 4000-pound load capacities. There is probability that this number of worm driven sizes will be increased, and this design will be built in every size that chain driven trucks are now constructed.

The company now constructs gasoline engine and electric motor driven trucks in a very wide range of sizes, and the worm and gear wheel drive has been adopted for a series of types that have recently been placed in the market. The gasoline trucks are from 1500 to 10,000 pounds capacity, and the electric trucks from 1000 to 12,000 pounds capacity. In general appearance the new machines do not differ materially from the older design, and the dimensions are practically identical, the main difference being in the power transmission system.

The model 26 worm driven chassis is 2500 pounds capacity, this being the same as model 25 chain driven, and model 41 worm driven, 4000 pounds capacity, is the same as model 40 chain driven, but model 31, worm driven, 3000 pounds capacity, is a new size. The statement is made that the new machines are the development from the actual experience of a company that has for a long time built trucks that have been amply proven in all kinds of service, and the design has been exceedingly simplified and adapted to best meet the demand of those who require thoroughly enduring and economical vehicles.

In developing the general design a great deal of attention has been devoted to perfecting it so that practically every service requirement will be met, and the owner will directly benefit because of minimizing the labor and time necessary to maintain the machines at highest efficiency. Care has been taken to thoroughly protect all wearing parts, means of adjustment are provided for compensating wear, ample lubrication is insured, and in addition there are many conveniences which are intended to make the work of the driver easier. The design has been well thought out and the entire assembly is of a character that will attract and interest the man who is seeking a machine that will afford him the maximum results.

The Unit Type Power Plant.

For the purpose of description the 2500-pound machine will be dealt with, and the principal differences in the dimensions of this and the other chassis will be given. For this reason, where not otherwise stated, the statements will apply to the smallest vehicle. The power plant is a unit type that includes the engine, the clutch and the power transmission gearset, and this has been unusually carefully worked out. The unit has been built specially for truck service and designed to obtain maximum power production with minimum consumption of fuel and lubricating oils, and high

The Chassis of the Model 26 Type A GMC Truck, Showing the General Characteristics of the Machine and Some of Its Operating Conveniences.

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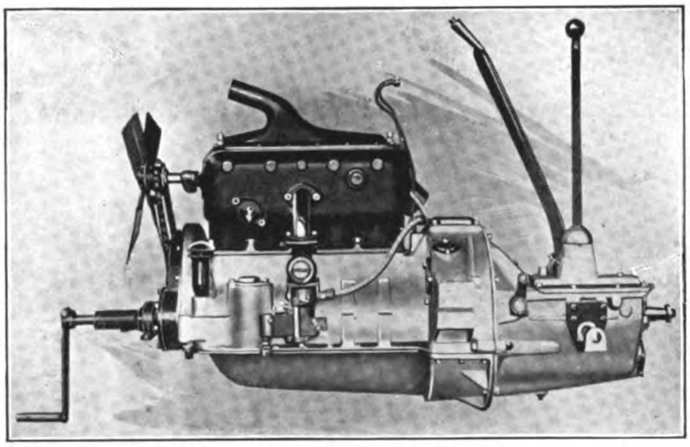


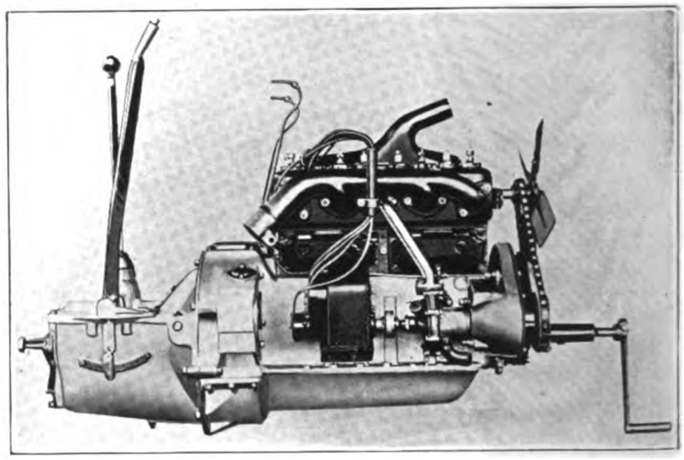
The Left Side of the Unit Power Plant Used in All the GMC Worm Driven Chassis.

operating efficiency and long endurance have been main objects in determining proportions. The engine is a four-cylinder, four-cycle, water cooled, vertical, L head type, with the cylinders cast en bloc, having bore of 3¾ inches and stroke of five inches, which has a rating of 22.5 horsepower by the S. A. E. formula. The stroke to bore ratio is 1.33:1, and this long stroke insures a much higher power production, the maker claiming that the engine will develop 30 horsepower when operated to its maximum efficiency.

The cylinder block is cast with the water jacket head open, this making for a better casting and insures that the water passages will be free and unobstructed. The cylinders are cast from a superior grade of gray iron with the water jackets integral. The head plate of the block is large, and besides being channelled, the better to direct the flow of water through the jackets, there is a very large outlet manifold just forward of the centre. This plate is retained by a series of cap screws. The valves are at the right side. The pistons are cast of the same material of the cylinders. The cylinder block is very carefully bored, reamed and ground, and the pistons are turned and finished with extreme care, the purpose being to obtain exact fit to insure uniformly good compression.

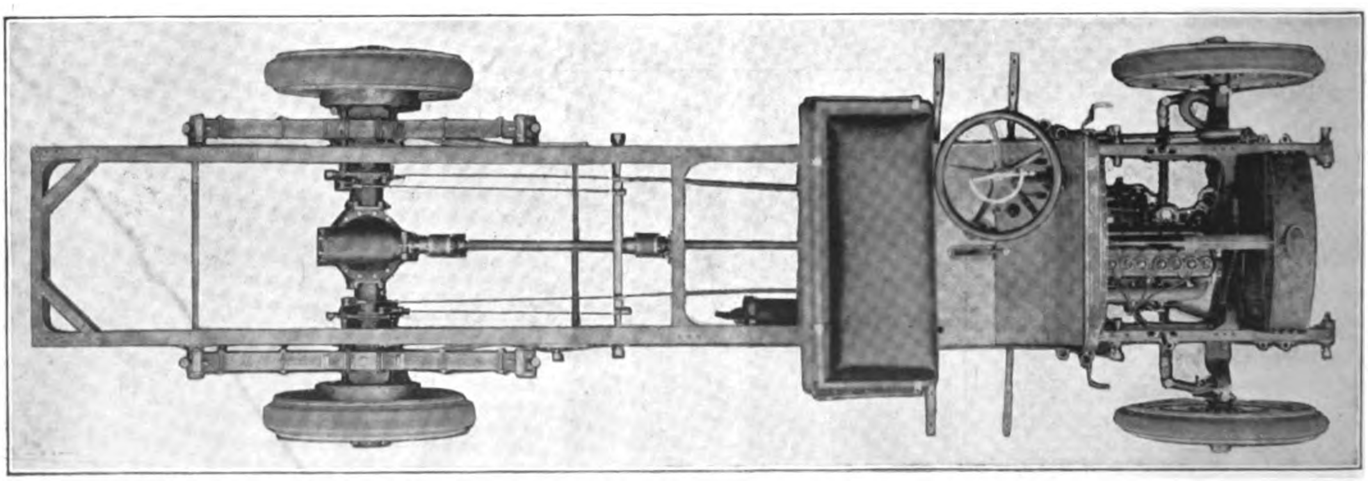
The crank case is in two sections, the upper part being an aluminum casting having a forward extension for the housing of the timing gears, and the rear extension is a bell housing for the flywheel. The upper section carries the three main bearings for the crankshaft, and the lower part is of pressed steel and forms the reservoir for the lubricating oil. The pressed steel section is extended at the rear to form the lower half of the flywheel housing.

The crankshaft is a nickel steel drop forging, heat treated and carefully ground, that is carried on three large main bearings of die-cast babbitt that are in bronze shells. The connecting rods are steel I section drop forgings, heat treated, and the piston wristpins are steel tube, hardened and ground, that are clamped in the small ends of the connecting rods and oscillate in bronze bushings inserted in the bosses of the pistons. The big end bearings of the connecting rods are die-cast babbitt metal mounted in bronze shells.



Right Side of the GMC Unit Power Plant, Showing the Water Pump and Magneto.

The camshaft is a steel drop forging, with the cams formed integral. This is carefully machined, ground and heat treated, especial care being taken in forming the cams. This shaft is mounted on the extra large bearings. The gears of the timing gearset have wide faces and are helical cut to minimize noise. The valves are 1⅞ inches diameter and are operated by the conventional tappet rods, these having the usual screw and nut adjustment to compensate for wear. The



Plan View of the Model 26 Type A GMC Chassis, with Dash, Footboards and Seat, Presenting the Features of the Worm Drive Power Transmission System.

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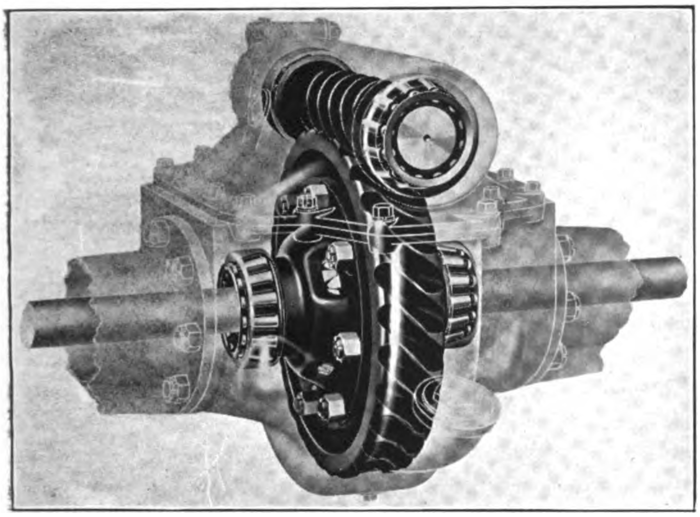


Phantom View of the Central Section of the Timken-David Brown Type Rear Axle and the Differential Assembly.

valves are of a size and have such clearance as will insure complete scavenging of the cylinders, this making for efficient operation. The valve mechanism is fully enclosed by two easily removable plates that are retained by finger nuts.

The Forced Water Circulation.

The engine is cooled by a forced circulation of water through the large jackets of the cylinders, the system including a large centrifugal pump that is driven by a gear from the camshaft gear of the timing set, the intake being at the base of the water jackets to obtain the greatest cooling efficiency. The tubular radiator is a special type that has been used for a considerable length of time with GMC machines. This consists of a central section or core that is contained in semi-steel top and bottom tanks and water columns, which form a rigid and solid frame. The radiator is assembled with gaskets and is unusually strong. The capacity of the radiator is very large and the efficiency is stated to be extremely high. The radiator frame is bolted to the chassis and is stated to be so well constructed that it is not affected by stresses of chassis distortion. The radiator may be taken apart for cleaning and in the event of accident any individual part may be purchased and replaced. Radiation is promoted by a 16-inch fan mounted on an adjustable bracket on the head of the cylinder block that is driven by a V belt from a pulley on the extension of the water pump shaft.

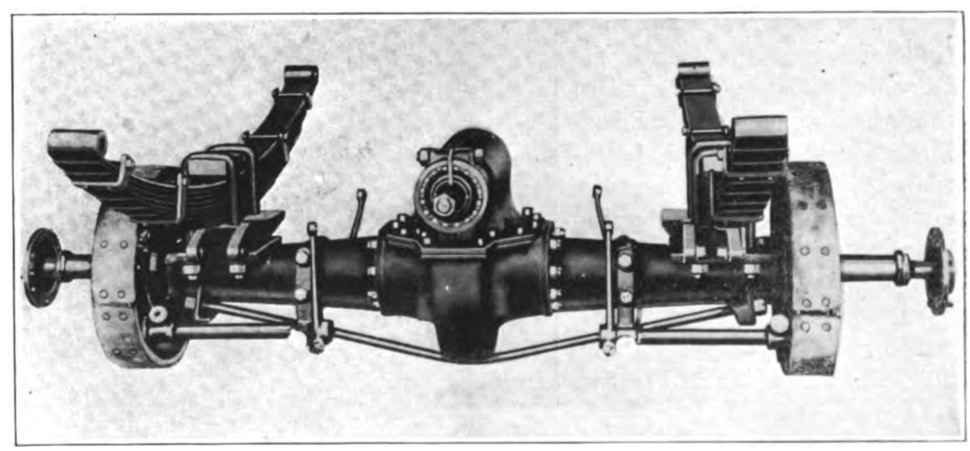
The lubrication is by a combination force feed and constant level splash system that has been developed with the purpose of obtaining positive lubricity in all operating conditions. The oil is contained in the reservoir and is drawn through a filter in the pump well and then is forced by a plunger pump operated by an eccentric on the camshaft through tubing to the rear main bearing and to the timing gearset. The excess oil drains into the oil pan, where a constant level is maintained and into this the big ends of the connecting rods sweep, distributing the oil for the cylinders, pistons, connecting rods, camshaft, centre and forward main bearings, the cams and tappet rods. The system includes a sight feed gauge located on the dash so that the driver may observe at any time the quantity of oil being supplied. A float indicator on the crank case shows the depth of oil in the reservoir.

The ignition is by a jump spark single wire system with an Eisemann high-tension magneto as the source of current, which is controlled by the usual hand lever on the steering wheel. The carburetor is an automatic float feed type that is said to supply a uniformly efficient mixture at all operating speeds, with a throttle that is operated both by hand lever and foot accelerator. The engine is automatically governed to afford a maximum vehicle speed of 16 miles an hour by a governor that operates a valve in the intake manifold above the carburetor. The power and flexibility of the engine is not influenced by the governor until the truck is driven to approximately the limit for which the instrument is set, as it is not operated by the hand lever or foot accelerator. The governor may be set and locked with a Yale lock, so that it cannot be changed or varied from the setting without the knowledge of the owner. This governor is stated to be very simple and exceedingly reliable.

The Power Transmission System.

The clutch is a dry plate multiple disc type of liberal proportions, and the clutch shaft is mounted on Timken roller bearings, while there is a ball thrust bearing on the clutch throw-out collar. The clutch and the transmission gearset are contained in a housing that is bolted to the rear of the crank case. The transmission gearset is a sliding gear selective type, having four forward speed ratios and reverse, with direct drive on the fourth ratio. The shafts are very large and the gears have liberal faces. The shafts are mounted on Timken bearings. The construction is such that both the clutch and the gearset are very accessible for adjustment or examination.

The unit power plant is suspended at three points,



The Timken-David Brown Rear Axle with Springs and Brakes, Used in the Three Models of GMC Truck Chassis, This Being a Very Heavy Construction.

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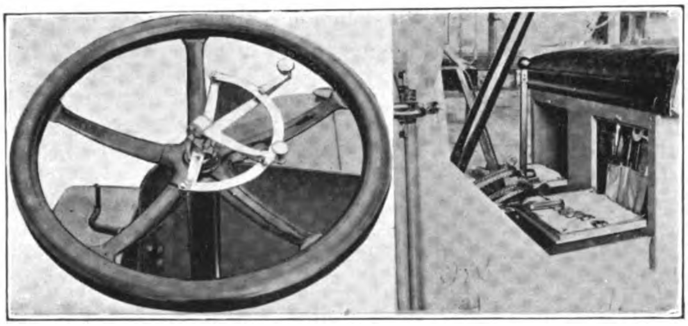


Characteristics of the GMC Design: At Left, the Hand Levers on the Steering Wheel; at Right, the Tool Compartment Beneath the Driver's Seat.

from the centre of the forward cross member of the chassis frame and from the side members, this protecting it fully against the strains of chassis distortion and insuring constant alignment of the shafts.

Driving Shaft and Rear Axle.

The main driving shaft is large diameter and is chrome nickel steel. It is in two sections, with universal joints at either end and in the centre. The forward section extends from the gearset case beyond a large self-aligning ball bearing by which it is suspended from a frame cross member, and the rear section extends from this bearing to the Timken worm shaft and gear wheel rear axle. The design of the shaft is to prevent whipping and vibration. The universal joints are simple, require no adjustments, and are enclosed in grease tight housings that fully protect them against dust and water.

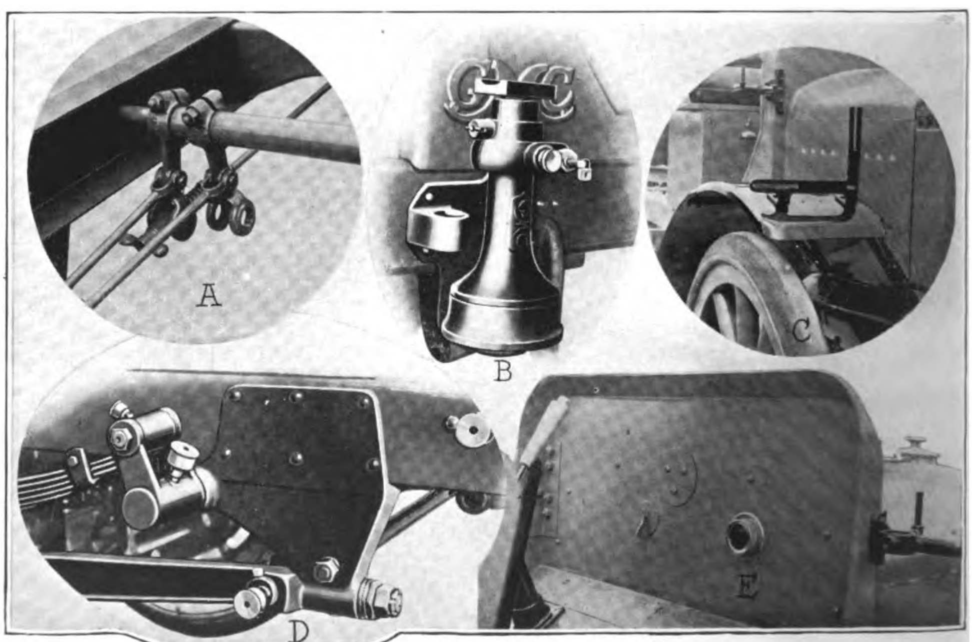
The Timken rear axle is a full floating type with the housing in three sections, the centre section containing the worm shaft, gear wheel and differential assembly, and the end sections are bolted to this. These carry the brake flanges. The worm shaft is made of a high quality of steel and the gear wheel is a special bronze, and differential assembly is very heavy. The driving shafts are large diameter chrome nickel steel, heat treated, with the driving plates forged integral. The inner ends are splined to engage with the differential assembly. The differential has four drop forged hardened and heat treated pinions. The shafts are full floating. This axle is fitted throughout with Timken roller bearings. The steel drop forged front axle is an I section, 2¾ by two inches, and is heat treated. The steering knuckles are drop forged steel and are heat treated, with hardened and ground steel bushings for all wearing parts The rear axle is trussed to further strengthen it.

The frame is a heat treated, open hearth, pressed steel channel section five inches wide, and tapers to each end. It has ample webs and is very strong. This is suspended on semi-elliptic, self-lubricating, high-carbon, oil-tempered springs, the forward set being 36 inches length and 2½ inches width, and the rear set 54 inches length and three inches width. These are fitted with bronze eye bushings and all spring bolts are hardened and ground. There are no centre bolts and the springs are installed with extra heavy top and bottom spring blocks and nickel steel spring clips. The radius rods are I section, with swivelled front connections with very heavy hangers, all the wearing parts being bushed. These rods are adjustable as to length and are a direct and positive connection between the frame and the rear axle, taking all driving stress. The wheels are wood, artillery type, 36 inches diameter, and are fitted with Timken roller bearings. These are shod with 3½-inch single solid tires forward and five-inch tires at the rear.

The Means of Control.

The drive is left side with the gear shifting and the emergency brake levers at the centre, and the clutch and service brake are operated by the conventional foot pedals. The brakes are a Duplex system, with two sets of Raybestos faced shoes expanding within pressed steel drums on the rear wheels. All brake shoes are interchangeable and the brake rods are so arranged that when the service brake shoes become worn the emergency brake shoes can be used for the service brake by simply crossing the brake rods. The steering gear is a screw and nut type, fully enclosed and with means for adjustment, with a 20-inch hand wheel. There are spring connections in the steering rod.

The gasoline tank is a seamless pressed steel cylinder of 20 gallons capacity, under the driver's seat.



Chassis Refinements and Conveniences: A, the Means of Adjusting the Brake Rods; B, the Jack Carried at the Side of the Frame; C, the Number Plate Bracket on the Fender; D, the Combined Spring and Radius Rod Hanger and the Convenient Grease Cups; E, Sight Feed Gauge on the Dash.

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The fenders are pressed steel and are one-piece. The dash and the seat riser are the same material. The equipment includes oil dash and tail lamps, mechanical horn, complete tool kit and jack.

The Difference in the Chassis.

The principal difference in the chassis is that the motor of the model 41—the two-ton load capacity—has a bore of 4⅛ inches and stroke of 5¼ inches, this giving a horsepower rating of 27.25 by the S. A. E. formula, and for this a power development of 35 is claimed by the manufacturer. This engine is governed to a vehicle speed of 14 miles an hour. The springs of this model are 40 inches length and 2½ inches width forward and 54 inches length and three inches width rear. The frame is 5⅞ inches depth. The tires are 36 by four inches single forward and 36 by four inches dual rear.

The chassis are built in two types for each model. Model 26, type A, has 130-inch wheelbase and trade of 58½ inches, with body space either 102 or 120 inches length, and type A has 144 inches wheelbase, with body space of either 126 or 144 inches. The chassis of model 31 are the same dimensions for both types A and B. For model 41 the wheelbase is 144 inches, with body space either 126 or 144 inches for Type A, and for type B the wheelbase is 158 inches, with body space of either 152 or 168 inches. The price of model 26 is $1800, of model 31 $1900, and of model 41 $2375, these being the same as the chain driven machines.

GRAND PRIZE FOR WHITE TRUCKS.

Official announcement has been made by the superior jury of awards of the Panama-Pacific Exposition that the White company has received the grand prize of the exposition for its motor trucks. The award is the only grand prize given for motor trucks and the highest honor for highway haulage equipment. The award was based on the quality of materials entering into White trucks, excellence of design, mechanical efficiency and low operating cost. The volume of business represented by the exhibit was also a factor, the White company being the largest manufacturer of trucks, both as to number and value.

INDUSTRY'S RESERVE CAPACITY.

Though very large orders for motor trucks have been received and are being filled by American manufacturers, these and the domestic demand are not as yet beyond the capacity of the industry to supply, and there are facilities and resources available for production that have not been producing. For example, one manufacturer of passenger cars who designed his first truck 10 years ago, has never produced any for public sale, but has kept his experimental models fully up to date and has in his plant complete plans and specifications for internal gear driven five-ton trucks which could be produced in considerable numbers within a day or two after orders had been received.

PERLMAN WINS PATENT SUIT.

After fighting from 1906 to 1913 to get a patent on demountable rims through the United States patent office, Louis H. Perlman has won a suit in the United States court against the Standard Welding Company of Cleveland and received a judgment which entitles him to an injunction against the company and a share of the profits from all its previous production. As this output is about 12,000 rims a day, which are used on many well known automobiles made in the United States, the amount of money at issue is very large. It is probable that the case will be carried to the United States supreme court by the defendants. If it is finally won by Mr. Perlman, he announces his intention of merely demanding a satisfactory royalty for the use of the idea. He will not prevent any company from using it if it is willing to meet his terms.

SPRAYING OUTFITS FOR AUSTRALIA.

Power spraying orchards has been very generally adopted in Australia of late and commercial houses in New South Wales are now carrying complete lines of the machines designed for this service. All fruit growers with orchards of considerable size are adopting power spraying, as it is found to be very much more efficient and economical than any other method. The machines usually sought range in capacity from 3½ to four gallons a minute for orchards requiring not more than 5000 gallons for a single application to those of 6½ to seven gallons a minute for those that require from 7000 to 10,000 gallons for a treatment.

WORCESTER FIREMEN BUILD TRUCKS.

In their off duty time men in the Worcester, Mass., fire department have built from purchased parts two motor combination wagons, on each of which the city has saved about $2000 as compared with the cost of complete vehicles of similar type. The work has been well done and the machines are said to be thoroughly efficient. One apparatus is to be shown at the annual fair held in Worcester. The Worcester fire department is now more than one-third motorized, and the translation will be continued by the investment of about $20,000 in equipment if Mayor George M. Wright has his way about it.

SMALL WAVERLEY TRUCK DESIGNED.

The Waverley Company, Indianapolis, Ind., is said to have designed and to have ready to market a small electric delivery wagon which will be sold for lower price than that for which Waverley vehicles have been listed.

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TRACTOR HAULS 48 TON LOAD.

Knox Machine Shows Remarkable Capacity in 30-Mile Country Trip.

The Knox four-wheel tractor, a machine especially designed for heavy load haulage, and for use with trailer trains, which was first produced early this year, has been proven in several trials to have unusual capacity—in fact very much more than the maker claimed to be practical. The first tractor built was demonstrated in New York City during winter weather with a semi-trailer, and the load with this was somewhat in excess of 10 tons besides the weight of the trailer.

The first real test of a Knox tractor in America was recently made from Cleveland, O., to Cook road, Lorain county, Ohio, a distance of 30 miles, and the machine in this work hauled seven oil tanks, the first as a semi-trailer, with the tractor carrying part of the weight, and the remaining six tanks as trailers. The accompanying illustration shows the train as it was made up and taken over the road.

Ohio highways are generally good as American roads are judged, but they are not constructed with the purpose of minimizing haulage cost or greatly economizing haulage expense, and the route on which the train illustrated was driven was largely average surface through a rolling country with frequent grades. The tank wagons used as trailers weighed 97,710 pounds, an average of 13,559 pounds each, or nearly seven tons, which would normally be a heavy load for a team of three horses, and a normal load for four horses for a haul of considerable length.

One of the wagons was adapted as a semi-trailer by removing the front wheels and the driver's seat, and a special bolster was built so that the forward end could be placed on the turntable on the rear axle of the tractor. The poles of the other wagons were taken out so that they could be coupled closely. With the train as shown, including the time for coupling and uncoupling, the 30 miles were covered in six hours, or somewhat better than five miles an hour, or twice as fast as horses could have drawn the wagons a part of the distance.

Aside from a part of the load of the first tank, which was supported by the rear axle of the tractor, all of the weight was carried on the steel tires of the tank wagon wheels, only the tractor wheels being shod with rubber. This very much reduced the operating cost as compared with other forms of motor vehicle haulage. The work done by this machine in this haul cannot well be compared with that done by animals, because the distance was approximately double what could be covered by horse teams in a single day, and the greater the mileage the more the superiority of the tractor outfit is evident.

The haul was, so far as actual results are concerned, even superior to what was done in the trials of the French army officers in France, a report of which was recently published in Motor Truck. In one trial abroad the tractor hauled five five-ton Pierce-Arrow trucks coupled together, each carrying two smaller boxed motor trucks, the five trucks and loads weighing approximately 43 long tons, up a hill with gradients ranging from six to eight per cent. The European ton is 2240 pounds, and computing the total weight on this basis the tractor hauled about 96,000 pounds, or about 1500 pounds less than the weight of the train taken from Cleveland to Cook road. Not only this, the Pierce-Arrow trucks were all equipped with roller wheel bearings, while the tank wagons in the test that has just been described were built with plain wheel bearings. This difference in equipment would mean that considerable more power would be necessary to haul the tank wagons, especially on the grades.

Undoubtedly there was loss of efficiency so far as the trailers were concerned, because the increase of friction with the plain bearings would necessitate an appreciable increase of power during the entire haul as compared with the test made in France. Not only this, the trip required more than five hours, during which this additional power must be produced. So

Knox Tractor Hauling Seven Oil Tank Wagons as a Semi-Trailer and Trailer Train That Weighed 97,710 Pounds, to Make a Delivery 30 Miles from Cleveland, O.

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far as could be determined the haulage capacity of the tractor has not been reached in this test, which was over roads that were not level and did not have surfaces on which the greatest tractive capacity could be developed.

Supplementing the trial made abroad, which was regarded as being superior to any that had ever been observed by the experts of the French army, the haul from Cleveland to Cook road was extremely satisfying, as it proved that the tractor was really more efficient than it was expected to be by the designer, and that for use with trailers it was remarkably economical. Undoubtedly, to obtain the greatest results, the trailers ought to be so constructed that the largest loads may be hauled with the least consumption of fuel and lubricant, and so designed that they can be controlled and operated with the fewest number of men. Efficient trailer brakes are necessary if large loads are to be carried. The tractor brakes may be sufficient ascending grades, but positive control of each unit is necessary in descending hills. The Knox tractor is equipped with a hydraulic brake that operates on the rear wheels, and in the French trials this was sufficient to hold the heaviest load on an eight per cent. grade. In fact the tractor and its train of five trucks was stopped and started in the middle of a hill without difficulty.

GENERAL MOTORS 50 PER CENT. DIVIDEND.

The hopes of the most optimistic holders of the General Motors Company's common stock were exceeded when the company paid a 50 per cent. cash dividend and the board of directors decided that regularly quarterly dividends would hereafter be paid at a rate to be determined. The gross sales amounted to \$94,424,841, as compared with \$85,371,302 for 1914. The number of cars sold was 76,068, as compared to 58,987. The increase in the number of cars was greater than the increase in gross business because of the lower prices at which the cars sold this year. The General Motors Truck Company is a subsidiary of this company.

NEW FOUR-WHEELED DRIVEN CHASSIS.

Four-wheel drive trucks and passenger cars are to be produced by the Twin City Four-Wheel Drive Company, which was recently incorporated in Minneapolis, Minn., with capital of \$500,000.

The Rubber Goods Manufacturing Company, New York City, has declared a quarterly dividend of 1¾ per cent., which was payable Sept. 18.

A cash dividend of 10 per cent. has been declared by the Reo Motor Truck Company of Lansing, Mich., which will be payable Oct. 1.

EXPERIMENTAL POST ROADS BUILT.

Thirteen states are co-operating with the federal government in the construction of 465 miles of experimental post road. The idea is that the roads will improve the rural mail delivery service and that the federal government will pay one-third of the expense of the construction, while the states pay two-thirds and then take charge of the maintenance of the roadways.

There was appropriated for this purpose \$500,000 of federal funds and this, with the state money, makes a total expenditure of \$1,500,000. The roads built include nearly every type: Dirt, gravel, macadam, bituminous macadam, concrete and clay and top soil construction.

The roads are built under the direction of the Department of Agriculture. As soon as the highways are completed the government representatives endeavor to secure the co-operation of the local municipalities in keeping them in good condition.

EDISON WANTS MILITARY ROADS.

Thomas A. Edison, chairman of the Civilian Advisory Board to the Navy Department, recently declared his approval of the proposal for the federal government taking over the care and maintenance of all roads that have strategic value for the defense of the coasts.

"These should be paved, widened, the grades reduced and the bridges built with sufficient solidarity to carry heavy trucks and artillery. Good roads are as important as railroads and much more elastic. Given good roads and plenty of motor vehicles, 1,000,000 men can be shifted 200 miles in 24 hours."

MAKES FIVE-YEAR CONTRACT.

A contract with a large exporting firm, with headquarters in New York requiring the delivery of more than 30 trucks a month for five years has been made by the Blair Motor Truck Company of Newark, O. These trucks, it is understood, are to be three tons capacity and the gasoline worm driven type which has been built by the company for a considerable period. Another order is said to be pending for the gasoline-electric trucks which the company recently designed.

FORD BUYS TRACTOR FACTORY SITE.

A report is current that Henry Ford has bought a 200-acre tract of land near Libertyville, Ind., for a testing ground and assembling plant for motor tractors.

The Morton Truck and Tractor Company, Harrisburg, Penn., has increased its capital from \$100,000 to \$1,000,000, actual increase notice stating \$420,000.

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TRUCKS THE MAINSTAY OF WARRING EUROPE.

The Principal Means of Removing the Wounded Men and Animals from the Battlefields, They Are as Well the Greatest Stimulus to Commerce and Industry.

VETERINARY ambulances on motor trucks are a feature of the motor equipment of the English armies in France. These ambulances were built and

French Hospital Unit and Staff—The Trailer Drawn by the Tractor Contains a Well Equipped Operating Room.

sent to the continent by an organization similar to the Society for the Prevention of Cruelty to Animals in the United States.

The trucks consist of a truck chassis on which van bodies are built, containing comfortable stalls for wounded horses. The vehicles carry them from the fighting line to the base veterinary hospitals.

Several of those in use by the English are mounted on English Commer Car chassis of four tons capacity. The bodies in which the stalls are built are very fine types of body work.

Each car will carry two horses. The stalls are divided, keeping the animals separate and providing plenty of room for them to move about. There is a rear run way, which is let down so that the horses can be led in, and there is a similar run way at the side for them to lead them out without backing down the rear run.

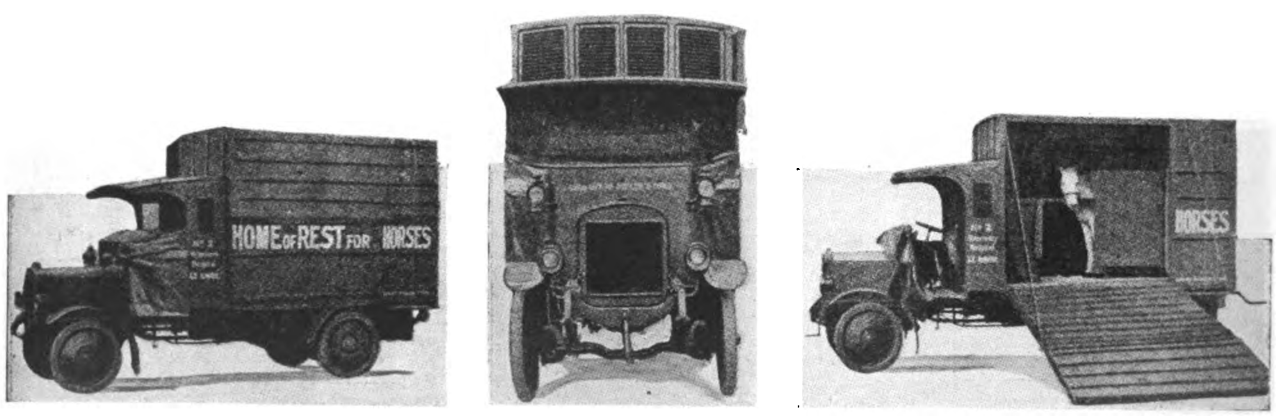
Sliding doors in the front wall immediately behind the driver's seat afford entrance to the body by a man. There is a manger in the centre of the forward partition from which the horses eat. Four grated windows insure ventilation. Block tackle is provided for letting down the run ways on which the horses enter or leave. In short, every provision has been made for the wounded horses.

London Passenger Traffic Motorized.

A recent census of London traffic compared with other similar censuses in previous years demonstrates a revolution in favor of the motor vehicle during the past few years. Passenger traffic particularly is almost wholly motorized. These tabulations, made every year since 1905, have been taken in Fleet street, as indicative of the traffic in the London central area; in Edgeware road, one of the main thoroughfares into and out of the city, which gives a good account of trade vehicles, public service vehicles and private carriages; and on Putney bridge on Sundays to indicate the nature of the city's pleasure traffic.

In 1905 the general use of motor omnibuses had not begun and none were plying over the Putney bridge. The next year 800 of them passed. In this year, too, the 'bus was well represented in Fleet street and Edgeware road, but its numbers nowhere exceeded those of the horse 'bus. In Edgeware road motor 'buses became more numerous than horse 'buses in 1907, in Fleet street in 1908 and at Putney bridge in 1910. In that year the horse 'bus, which had been rapidly decreasing in numbers, ceased to be a factor in London traffic and it has now quite disappeared.

As regards taxicabs, the motor surpassed the horse



An English Veterinary Ambulance:. At Left, the Vehicle Ready for the Field; at Centre, the Body Equipment from the Front; at Right, the Side Run Lowered to Remove the Wounded Horses.

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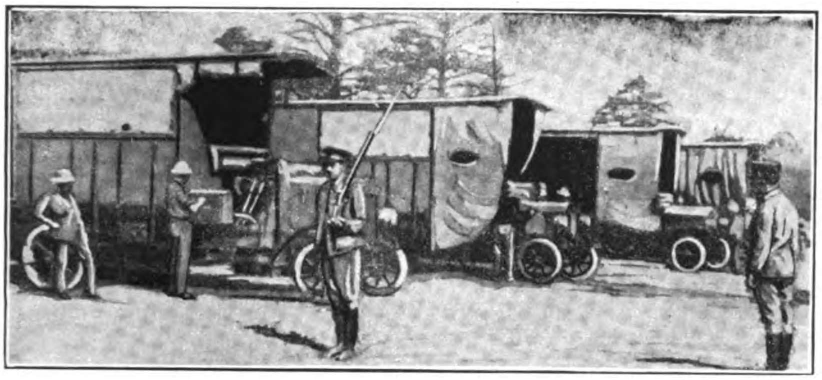
at Putney in 1907 and in Edgeware road and Fleet street in 1910. In 1911 the horse cab represented less than 20 per cent. of the cab traffic and it now has about one per cent. of that traffic.



The Motor Transports Attached to the Australian Contingent of the English Army, an Equipment That Has Been Very Carefully Developed.

Among trade vehicles, in England as in America, progress has been less rapid. In 1906 the commercial vehicle represented one per cent. of the traffic and in 1914, 14 per cent. of the traffic on Edgeware road; in Fleet street, where very dense traffic is against the motor vehicle, it is at present only 10 per cent. strong.

Private cars at Putney bridge of motor type have increased from 40 per cent. in 1905 to 98 per cent. in 1915. In Fleet street it has risen from 14 per cent. in 1907 to 60 per cent. in 1915. In Edgeware road it has risen from 47 per cent. in 1907 to 82 per cent. in 1914. Figures for 1914 are given in this connection because the war has introduced disturbing conditions for 1915.

The extent of the revolution is made plain by the statement that in the Sunday traffic at Putney bridge the total in 1905 was divided into 13.15 per cent. mechanical and 86.85 per cent. horse, and in 1915 it is 98.28 per cent. mechanical and 1.72 per cent. horse.

Germany Sustains Tire Chain Patent.

The German Reichsgericht, supreme court of the empire, has rendered a decision that all automobile tire chains that creep along the tire are infringements of the Parsons patent, under which Weed anti-skid chains are made in America. Romain Talbot manufactures chains under the patent in Berlin for the German market. This decision coincides with that of the United States supreme court.

Recommendations have been made to the British government by a committee appointed to consider food supply that a large amount of agricultural machinery be purchased in America and placed at the disposal of English farmers.

There has been great interest in Europe since the war began in agricultural motors and this equipment, if purchased, will quite likely be largely of that type. To protect English crops, if they are grown, it is recommended that the government guarantee a stated price for the wheat crop and impose such duties on imported wheat as will enable English growers to dispose of all their product at a good price. The amount of American machinery required to carry out this plan is likely to be considerable.

Although they are so busy on war department orders that they cannot deliver a car or truck to private consumers, the British motor manufacturers are making every effort to secure from the government either an absolute prohibition of the import of American vehicles for private use or a very high duty.

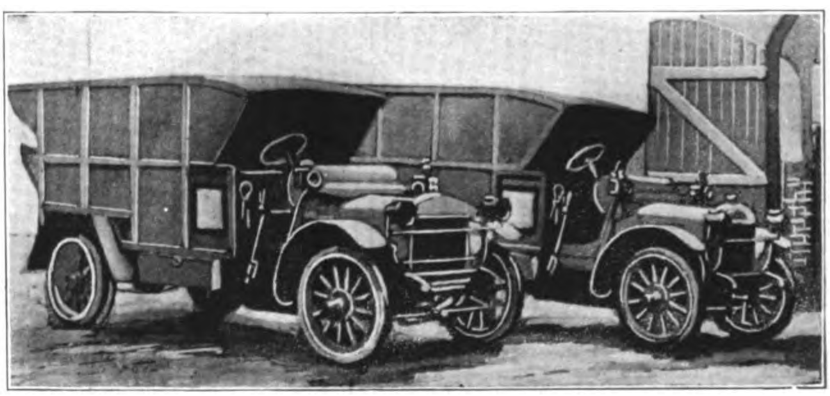
The reasons given for this movement are that every purchase of an American car helps to decrease the value of English exchange in America—at the time this was written the value of an English pound had fallen from $4.865 to $4.72—and that if the Americans are allowed to saturate the market with American product there will be no orders waiting for the English factories when they are ready to resume manufacture for private use.

There is strong reason to believe, however, that the real reason for the movement arises from the fact that the makers have been thoroughly frightened by excellent service of American trucks selling at lower prices than their own, both in the war field work and in the hands of private users. The recent rapid progress of American design and the reduction in prices is making the position of the English manufacturers very difficult and they evidently fear that if the American products are once thoroughly tried out in England there will be no market left for British built machines. They evidently fear it will be impossible to get the same volume of business or the customers they had after the war.

May Build Cars of Imported American Parts.

There is also evidence that many of the more far-seeing motor manufacturers in Britain have come to the conclusion that the competition of small scale English production with highly efficient large scale American production will be permanently impossible.

They have observed that Ford imports his motors, axles and vital parts from the United States and makes the rest of his car in England, and they are preparing



Two of the Specially Equipped Cars That Are Used by the Czar and His Suite in His Visits to the Armies in the Field.

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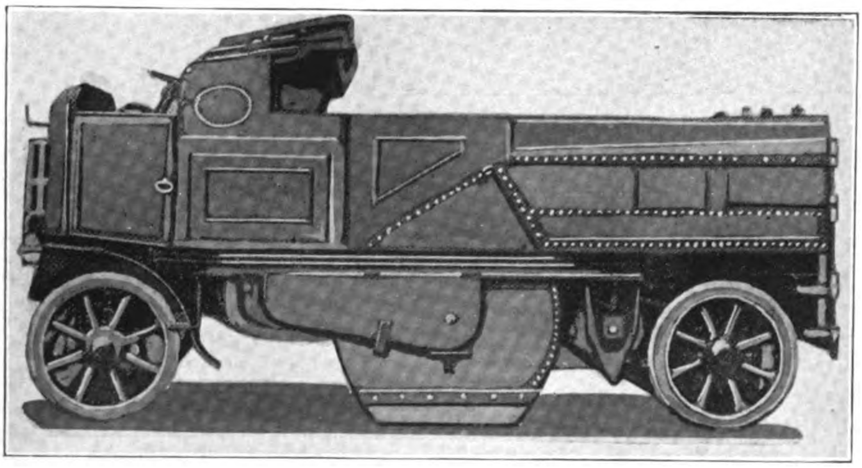
to adopt the same system. The Continental Motor Company of Detroit was recently called upon to design a special type of small bore, high efficiency engine for the Morris Oxford Company of England, and another large English manufacturer has sent out inquiries for a small size eight-cylinder engine.

By importing their vital parts from America at American prices and finishing the rest of the car in England, according to English ideas, the British makers will doubtless be in a much more formidable position so far as American competition is concerned. The cars would, however, be largely American products.

American Chance to Win Australian Trade.

With hay and horse fodder in Australia selling at $50 a ton, there has been an enormously increased demand for motor vehicles in that colony. There was a large stock of new and second-hand cars of all types on hand at the beginning of the war, but this has long ago been entirely absorbed.

Most of the heavy duty trucks used in Australia have been of British manufacture, but since that entire output has been devoted to war purposes, that market has been turning rapidly to American products. Such English trucks as have been available have been increased in price, while American prices have been decreased rather than following this tendency in price. Many Australians believe that the war will have the effect of permanently losing the market of the colony by the English makers.



The Hill Vacuum Road Cleaner, a New Type of Machine That Sprinkles the Street Before Sweeping It, Recently Developed in England.

AMERICAN FINANCIAL STRENGTH.

That the fear felt when war in Europe was first declared, which resulted in the closing of the New York stock exchange, the restriction of credits and the practical tieing up of business, including many concerns in the motor vehicle industry, was entirely misplaced and unfounded is the declaration of no less a financial authority than the New York Times.

The stock exchanges were closed because of the belief that foreign buyers were anxious to raise money by dumping their American securities on the local markets in such quantity that prices might be hopelessly broken. There was great fear that American interest due to be paid to Europe could not be met.

But now, after one year of the war, the financiers find that America is more than able to stand on its own financial feet. Europe has bought much American stock as the only really safe investment under the disturbed condition in other parts of the world. Prices in all lines are much higher than they were before war was declared.

Instead of a problem of meeting American payments to England, the real problem is that of collecting English debts to America. South America, hopeless of securing its usual capital from European sources, is turning to the United States and signs multiply that from now on New York will be the real financial capital of the world.

TIRE SHORTAGE IN SCANDINAVIA.

Owing to the interference of the English navy with the trade between the United States and the Scandinavian countries, the regular market stock of American tires in both Sweden and Norway has been exhausted and cannot be renewed, and the taxicab companies in Stockholm and other cities will be unable to keep their machines running more than a few weeks. Private owners can secure no new tires and the small number in the hands of dealers are so valuable that they are being rented by the day instead of being sold. The situation is much the same as to gasoline. Ships from America with both commodities are held up by England through fear that the freights would be exported to Germany, notwithstanding the Swedish law, which prohibits exportation at this time.

AUSTRALIA USES AMERICAN TRACTORS.

On two large farms operated by the New South Wales, Australia, government, operations are carried on with Holt caterpillar tractors, made in the United States. These were adopted because the nature of the ground was such that a caterpillar drive was necessary and the Holt tractor, as the oldest and most thoroughly tried machine of that type, was given preference.

The farm at Woodlands consists of 27,000 acres of cleared land, 12,000 acres of which have been plowed. At Trangie 2300 acres have been cleared and 1500 plowed. Large purchases of all types of machinery for the farms have been made by the government.

The Hayes Truck Wheel Company, St. Johns, Mich., located in the plant of the St. Johns Table Company, is to be incorporated with capital of $100,000. C. B. Hayes, president of the Hayes Wheel Company, Jackson, Mich., is president of the company.

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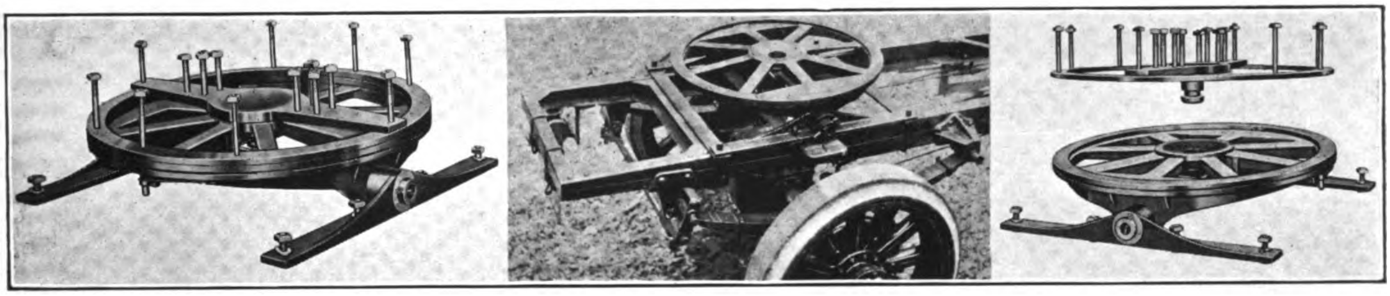
THE MARTIN PATENTED ROCKING FIFTH WHEEL.

OBTAINING the fullest value of normal motor vehicle traction or haulage capacity, so that the load may be doubled without increasing the fuel consumption or lessening the speed, and without materially increasing the expense has been the purpose of every progressive engineer and designer. Originally the main object was to construct large units, but experience taught that the operating expense was generally proportionate to size, and unless full loads could be carried at all times these vehicles were not economical, or at least could be operated with sufficient saving to justify investment.

Attention was diverted to smaller machines, limited as to loads, but having more speed. With these the limitations of size impelled fast driving, with the consequent destructive wear. There were those who sought to adapt trailers, with which there were disadvantages so far as handling in traffic or narrow streets, and there are few trailers that are so designed that they will endure the peculiar stresses when hauled by a tractor.



The Martin Patented Rocking Fifth Wheel: At Left, the Complete Assembly; at Centre, Installed on a Truck Chassis; at Right, the Sections Separated.

Several engineers have developed trailers that are practical in construction and which can be hauled with absolute control, but no system of braking the trailers has as yet been developed and backing is not practical, so that what may be regarded as satisfactory trailer trains for road tractors have not been perfected, although some very finely designed tractors have been produced that have been remarkably economical in service.

Tractor and Trailer Development.

The development of tractors and some forms of trailer equipment has been the work of Charles H. Martin for a number of years, and he was one of the first, if not the first, engineer to realize and investigate the need of special means of coupling a trailer body to a tractor when the equipment is what is known as the semi-trailer—that is, the tractor has three or four wheels for steering and propulsion and draws a body mounted on two wheels, the forward end being carried by the tractor.

His investigations, which have been amply proven by tests and trials of others, have established that the average vehicle designed and built for freight carrying can draw a much larger weight than can be placed on the carrying platform, unless the load is metal or some other equally heavy material, and that in what may be regarded as normal haulage conditions that the practical freight can be estimated as double the capacity rating. That is, a ton truck engine has adequate power to haul two tons, although the vehicle ought not to be overloaded. To utilize this power the trailer or the semi-trailer equipment is necessary.

Doubles the Freight Capacity.

This haulage power as compared with actual freight carrying can be applied to every form of transportation, either manual, animal or vehicular, and the practical adaptation of this power has been the problem that Mr. Martin has studied. In every experiment or service a more satisfactory and economical equipment has been obtained by utilizing the hauling power of the vehicle and by carrying the freight in a semi-trailer. Having a two-ton load capacity truck good judgment demands that it be loaded to its rating and no more; that it be driven to a normal speed and not faster. To exceed either the load or the speed means probable damage and perhaps quick deterioration.

But with a semi-trailer body with capacity for four tons, so designed that not more than half the weight of the freight is carried on the truck and the other half is carried on springs on a dead axle, with the wheels shod with solid metal tires, a load double the normal can be hauled at practically the same speed. With this the fullest measure of usefulness of the unit is obtained. It has the mobility, the ease and certainty of handling, the economy and the reserve utility of the truck, and despite the doubled freight the cost of tires is not increased. The outfit can be handled in traffic and in narrow highways, can be backed with absolute certainty, and it can be worked with several bodies that may be loaded and unloaded while the truck is doing haulage work.

The Martin Rocking Fifth Wheel.

The coupling of the semi-trailer to the truck is of great importance, because the forward end of the body must be carried so that it will have perfect stability on surfaces that are not level, so that the truck may be turned in any direction and have the same support, and so that when the truck and the body are at different angles with reference to the plane of movement

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the support shall not be weakened. This coupling is made with the Martin patent rocking fifth wheel, a fitting that can be installed on the rear of the frame of any truck and the machine adapted for the greatest economic use.

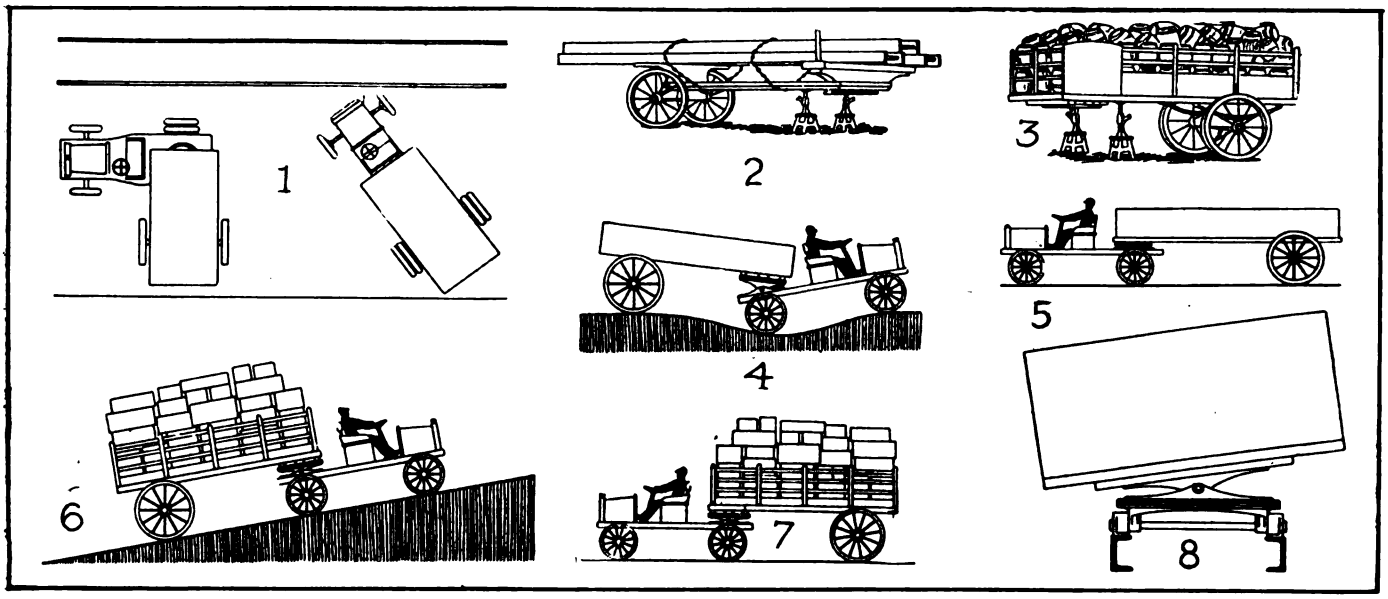
The Martin fifth wheel converts the truck so that it serves exactly the same purposes that a team of horses, pole, front axle and wheels serve with an animal truck. In this case the truck carries what is often known as turntable. There is a pair of brackets that are either bolted or clamped to the frame, and which support the trunnions of a circular bed, which resembles a wheel. What might be termed the hub is an opening with depressed edges, so that engagement may be easily made. The upper section of the wheel is a circle with a heavy bisecting plate that carries a heavy stub or pivot in the centre that drops into and engages with the central opening of the lower portion of the wheel. This upper half is bolted to the frame or bolsters of the trailer body.

less efficient. In the event of several bodies being used as many upper sections as are necessary can be permanently attached to the bolsters or frames and when desired a truck can be used for as many different services as there are special semi-trailer bodies.

Conversion of Bodies Very Simple.

Th means of conversion are extremely simple. Unless the body is very light a pair of jacks for each unit is desirable, for this obviates the use of wooden horses or other means of supporting the forward ends when the truck is withdrawn, but when the bodies are to be loaded while standing more substantial supports are needed to insure against them dropping should they be struck violently. With a jack placed at either side the end of the body is lifted so that the stub of the top half of the fifth wheel is clear of the lower half, and then the truck can be driven away.

With semi-trailer equipment passenger or freight carrying vehicles are possible, and the trailers may be long or short wheelbase, end or bottom discharging—



Utility of the Martin Fifth Wheel: 1, Semi-Trailer Occupies Less Street Space; 2, Body Loaded with Lumber Jacked Ready for Truck; 3, Trailer Loaded During the Absence of the Truck; 4, Hinged Connection Eliminates Vehicle Strains on Uneven Surfaces; 5, Truck and Semi-Trailer Can Be Backed Perfectly; 6, Truck Carries Sufficient Load to Have Full Traction; 7, Half of Load Carried by Truck; 8, Unstabilized Effect of Body Having Longitudinal Hinged Connection.

With the ordinary wagon turntable the forward axle may be turned in any direction, but in the event of variance in the surface of the highway one section of the circle may support the body. The king bolt, which corresponds to the wheel stub, sustains the draft stresses. With the Martin fifth wheel the trunnions of the lower section allow a longitudinal movement of the body for the truck, so that there is no strain upon either, although the support of the load by the truck is not varied, and the transverse or crosswise stress that may result from turning, or when on crowned highway surfaces, is compensated by the truck springs.

This fitting is designed for heavy service and there is no reason for its adjustment and it requires absolutely no attention. The lower part of the fifth wheel can be bolted or clamped to the truck or vehicle frame, so that it may be quickly removed, yet it will not be

in fact any type of equipment where large capacity is essential.

While the statements may be applied to trucks in general, the Martin fifth wheel can be used with a Ford chassis, so that with a trailer the vehicle shall have a load capacity of 1500 pounds, and this is designed to be attached with clamps so that the change can be quickly made from passenger to freight carrying and without the use of special tools.

The Ford equipment is built with an 18-inch circle and sells for $25; for the trucks of from one to three tons capacity it has a 32-inch circle and sells for $80, and for four to five-ton trucks with a 36-inch circle, selling for $90. Extra upper circles are supplied at the respective costs of $3, $8 and $9. Wagons can be converted for use with this equipment, but better results are generally obtained with heavier wheels and axles because of the heavy strains upon them.

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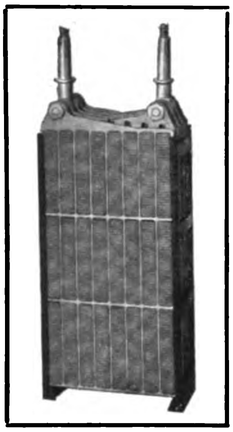
ELECTRIC VEHICLE PRACTISE.

The Electrolyte of Edison Alkaline-Nickel-Iron Cells, Characteristics in Operation, Period of Usefulness, Testing for Height and Flushing and Renewing—Hydrometer Readings and Influences of Temperature on Density.

By William W. Scott.

THE Edison alkaline-nickel-iron cell when it is assembled is so built that it cannot be opened save at the vent or filler cap. So far as experience has taught there is no reason why it should be disassembled at any time, for the element does not deteriorate as do those of other types of cells. The interior of the can or container is covered with a plating of nickel, fused into the surface of the sheet steel, and because of this treatment the nickel cannot flake or "peel." The grids and the pencils containing the positive active material and the pockets packed with the negative active material are similarly plated, and not only is the metal fully protected, but the coating of nickel insures the greatest activity of the electrolyte that contacts with it.

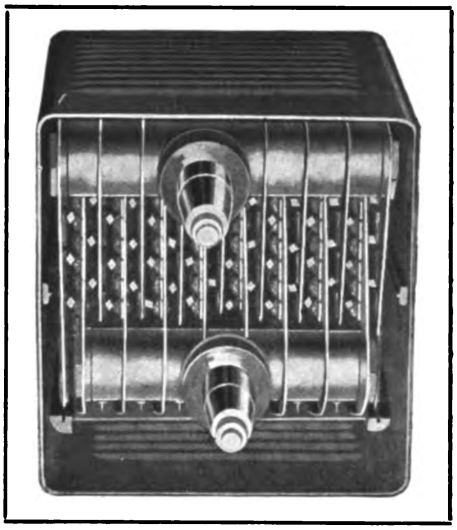
Nickel has great conductivity and the combination of the flake nickel with the nickel hydrate with which the pencils or tubes of the positive plate are filled insures the intimate contact of the material and the certain conduction of the current through the grids. The iron oxide with which the pockets of the negative plates are filled is combined with a small volume of mercury to insure the greatest degree of conductivity, although iron is an excellent conductor of electric energy.



Full Element Assembled for Installation in Cell.

The electrolyte is a saturated solution of distilled water that has absorbed 21 per cent of potassium hydrate or caustic potash. Much care is taken to insure the purity of the electrolyte. The potassium hydrate is prepared at the Edison Chemical Works, Silver Lake, N. J., the chemical department of the Edison companies, a plant that produces practically all of the chemicals used by the different concerns in the group. One of the reasons why it is so carefully produced is to be sure that it is chemically pure, or much more free from impurities than what might be obtained in the open market. Until the European war practically all of the potash used in this country came from Germany, where there are large natural deposits.

Potash is a very strong alkaline and in crude forms is freely used for cleaning, attacking grease in any form. It is often used in metal working to thoroughly clean the surfaces. In the form of the electrolyte the solution would undoubtedly act upon organic matter that it might contact with, but this would not affect the cell chemically. The reader has been informed that metals, carbonates and organisms introduced into lead-acid cells will have a deteriorating influence, some of them more rapid than others, but the chief danger from foreign matter in an alkaline-nickel-iron cell would be from the accumulation of particles upon the surfaces of the plates, which might obstruct the complete contact of the electrolyte with the active material, which would of necessity lessen the capacity of the plates and consequently affect the cell.



Top of Cell Container, Showing Element, Before Welding on the Top.

That the solution may be as free from impurities as is possible, the water is distilled and extreme care is taken in mixing the electrolyte. The water is thoroughly protected from any possibility of introduction of foreign matter, and the containers in which it is stored are of a character that insures the quality of the content. Into the solution is placed a small volume of lithium hydrate, a solution of a metal similar to potassium. The purpose of the lithium is to increase the activity of the electrolyte.

The Top of an Edison Cell Can Before Welding In, Showing the Pole Openings and Filler.

Because of the manner of constructing the Edison

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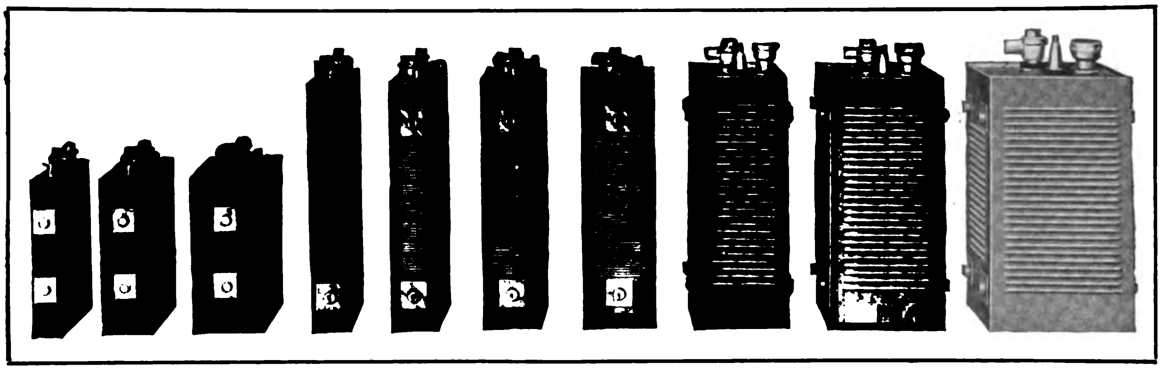
alkaline-nickel-iron cell the system of inspection is very rigid and when ready for the "forming" or really the test of capacity, the cells are filled with electrolyte and then they are subjected to a series of several charges and discharges before they are regarded as being in condition to be installed in service. All cells are required to meet the requirements of the standard —that is, to at least equal the rated capacity—before they are passed to the sales department, and this "forming" process is expected to develop any condition that might be regarded as affecting the efficiency of a cell.

The A types of cells are used for vehicle batteries, and as has been previously stated, these do not differ from the H types, save that they contain less electrolyte. The H type cells are generally used for installations that are not easily accessible and cannot be conveniently reached for examination and attention. The H cells have a deeper space above the plates and are filled to a greater depth, as will appear in the statement which will refer to the detailing of equalizing or flushing.

The filler cap of the Edison cell contains a hemispherical valve which is intended shall be opened when the pressure of gas within the container is sufficient to lift it, but the vent is so formed that any of the solution that may be carried upward in the form of bubbles during charging shall drain into the cells when the bubbles break. This cap should never be opened save for the purpose of determining the height of the electrolyte and for placing distilled water in the cell, or for renewing the solution when occasion shall require.



Row of Completed Edison Cells, Sized from Left to Right, the Low Being the B Type and the High the A Type—The Latter Are Used for Vehicle Propulsion.

When the cells are shipped from the factory they are filled with electrolyte and discharged, except in the event of exportation, when the cells are empty, and with the shipment is sent specific directions for filling the cells and forming them. The cells are usually crated so that they can be carried in one position only, and when received ought to be in condition for service. However, there is possibility of some of the electrolyte being lost, and for that reason all of the cells should be examined for the height of the electrolyte, and should the level be found to be below the height specified, the suggestion is made that the manufacturer should be communicated with and advice will be given for the treatment of the specific case.

The importance of the electrolyte being at the correct height in the cells cannot be too strongly emphasized. Because of the construction and design of the cells a comparatively small volume of electrolyte is used, and unless the full area of the plates is covered by the solution the rated capacity of the cell will not be obtained. To avoid the necessity of giving constant attention, the electrolyte is placed at a level that will insure replenishing of its volume by distilled water at intervals that will depend largely upon the use made of the battery.

A result from charging that is characteristic of all liquid cells is that the water in the electrolyte is diminished with each charge given. The water is decomposed by the action of the electric current and when the current has sufficient amperage, or near the end of the charge, bubbles will rise from the surface of the electrolyte. These bubbles are filled with hydrogen gas and are carried upward against the top of the containing can. When the accumulation of gas has created sufficient pressure the valve in the filler cap will open and the gas will escape. The form of the valve is intended to minimize the escape of the bubbles, each of which represents a very small volume of water, but eventually sufficient water will be carried out of the cell so that to maintain the electrolyte at a height to submerge the plates distilled water must be added as often as is necessary.

In the water of the bubbles will be a very small proportion of caustic potash, a volume so small that it is negligible in one sense, but the loss and the replenishments of water will eventually so weaken the electrolyte that it must be renewed. This loss is precisely the same as is experienced with lead-acid cells, in the charging of which there is a loss of sulphuric acid that is carried out of the cells in the water of the bubbles, gradually weakening the electrolyte, so that in time it must be renewed to maintain standard efficiency.

The standard solution of the Edison batteries contains 21 per cent. of potassium hydrate and a small percentage of lithum hydrate, and these proportions must be maintained to insure the efficient activity of the cell. The gradual weakening of the solution will be dependent largely upon the character of charging, but the period that one filling of the electrolyte can be depended upon to afford satisfactory efficiency will average approximately 300 complete charges and discharges, or cycles of operation, and will correspond to about a year of service, assuming that a battery is used six days a week. The Edison company recommends

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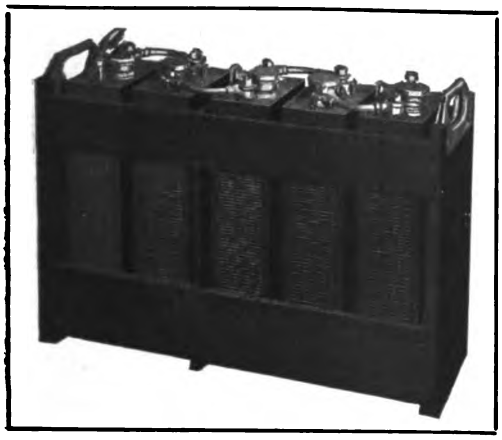
that the electrolyte be renewed from nine to 11 months after filling, which recommendation is based on obtaining positive results, and takes into consideration that the average battery in service may not have been as carefully maintained as an Edison company's battery engineer would advise. At all events, the renewal of the solution at the expiration of the period stated is based on experience and the advice is safe to follow.



A Series of Edison Cells Assembled in a Tray or Crate Usually Used in Vehicle Installations.

The specific gravity of the potassium hydrate solution originally placed in the cells is about 1.200 when measured by a hydrometer, but it may be as high as 1.230. When the solution has a specific gravity of 1.160 or less, it should be renewed. The renewal electrolyte ought to be obtained from the Edison company, for it will have the correct proportions and will be pure. This solution differs from the original in that it has a specific gravity of 25 per cent. of potassium hydrate and it will contain 15 grains of lithium hydrate to the liter. The reason for a stronger solution is that the plates are saturated with the weaker solution, and to compensate for the weakening influence of the electrolyte in the plates when the battery is placed in service the liquid is made with greater proportions of potassium hydrate and lithium hydrate.

The reader should understand that the only value of hydrometer readings with the electrolyte of Edison cells is to determine the strength of the solution. The specific gravity of the solution is not changed by charging or discharging, such as is characteristic of the lead-acid cell, and no indication of the voltage can be obtained by hydrometer tests.

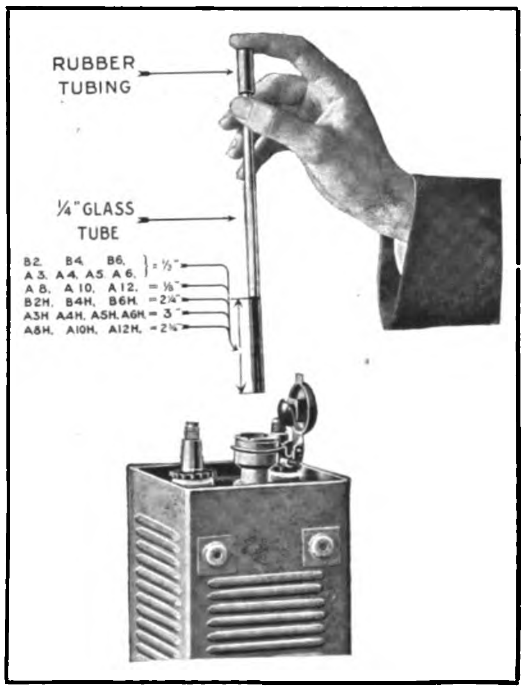
The solution should be ordered for the number of cells, giving the type and the number of cells in the battery, and it is shipped in steel drums. The following quantities are necessary for a single cell, and for a battery of 60 cells of the different types stated, the quantities being given by liters and by gallons, the liter and gallon for the single cells and by gallons for the 60-cell battery:

Type Cell	Exact Liters	Volume Gallons	Weight Pounds	60 Cell Battery Pounds	60 Cell Battery Gallons
A4	1	0.27	2.80	180	16.8
A5	1.25	0.33	3.44	225	21
A6	1.50	0.40	4.20	270	25.2
A 8	2	0.53	5.55	354	33.6
A10	2.70	0.72	7.9	474	45.6
A12	3.20	0.87	9.4	564	54

Upon receiving the battery the precise height of the electrolyte in each of the cells should be determined, for this is extremely important if efficiency is expected. The better manner of learning the condition of the electrolyte is by taking a piece of glass tube .25 internal inch diameter, from eight to 12 inches length, and on one end placing a piece of rubber tube that will fit snugly and is from two to three inches length. The end of the rubber tube should be cut squarely across. By introducing the end of the glass tube into the cells and placing a finger on the end of the rubber tube in the manner illustrated, the depth of the solution can be ascertained when the tube is withdrawn from the cell. The tube can be marked if desired with a file wet with turpentine to indicate different measurements. The correct height for the type B2, B4, B6, A3, A4, A5 and A6 cells is .5 inch above the plate tops, and for type A8, A10 and A12 cells .125 inch above the plate tops. To utilize this method of testing, which is illustrated, a tube not less than .1875 internal diameter should be used, and the ends should be straight cut, so that when placed in the cell the end shall rest evenly on the plates.

The electrolyte should never be permitted to be so low that the tops of the tubes of the positive plates are above the surface, and filling higher than the levels stated is not advised because of the probability of the depletion of the solution by being forced out in bubbles by the escaping gas.

In filling the cells to the height advised nothing but distilled water should be used. This is just as important with Edison cells as with lead-acid batteries. There are those who maintained that boiled rain water or melted snow or ice can be utilized, but these are quite certain to contain impurities, and these will undoubtedly affect the efficiency of the cells. Under no circumstances use aerated or carbonated water. Practically all drinking water contains carbonates and salts that will have deteriorating influences.



The Method of Testing the Height of Electrolyte by Removing a Small Quantity with a Vacuum Tube.

Distilled water can be obtained at comparatively small cost and in sufficient quantities to insure having

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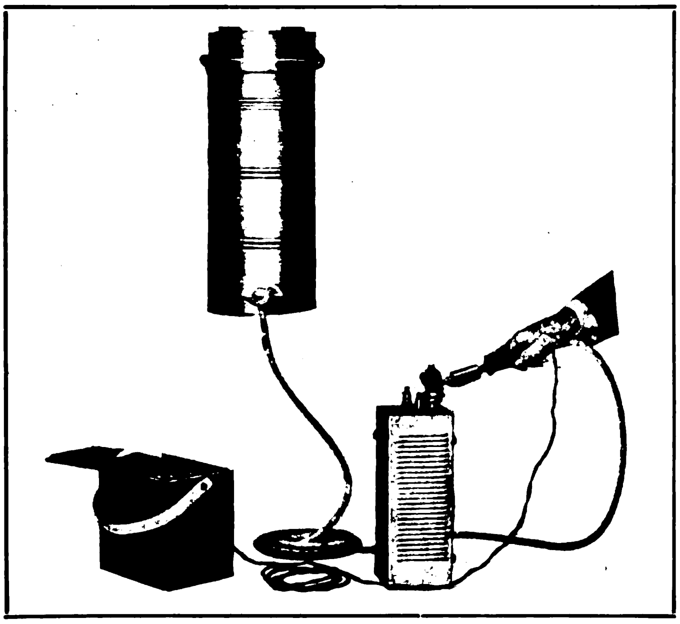
a sufficient supply to meet all normal requirements. The distilled water should not be left exposed to the air, and it should be kept in well corked glass bottles or carboys. When the water is placed in the cells care should be exercised to use only vessels that are positively clean, for any foreign matter that has been poured into the cell cannot be taken out without removal of the entire content. Use of distilled water is useless unless care is taken to realize the benefit of its purity. That the electrolyte shall not be exposed to contamination the filler caps of the cells should only be raised, save for the fillings.

Greater accuracy in filling, which means an economy of water and more certainty that it is pure, can be obtained with the use of the special filling apparatus designed for this purpose. This electric apparatus is illustrated, and consists of a metal container that may be suspended on a wall or any convenient place so as to have the required gravity for promoting the flow.



The Special Equipment with Electrical Alarm Designed Specially for Equalizing Cells with Fresh Distilled Water.

This container is covered to protect the content. At the bottom is an outlet to which a rubber tube is connected. At the other end of the rubber tube is a filler nozzle that is curved so that it may be placed in the filler of the cell. A flexible wire cable atached to the nozzle is attached to a small battery of dry cells. On the battery box is a bell operated by an armature. There is a valve at the outlet that is operated by a thumb lever, a spring normally keeping it closed.

The outlet of the nozzle is a steel tube and surrounding this is a metal sleeve that does not extend to the end of the outlet. In using this the nozzle end is placed in the filler opening of the cell as far as possible, so that the metal sleeve will make good contact with the rim. Pressing the thumb lever will open the valve and the water will flow into the cell through the tube. When the solution has reached the height for which the instrument is designed, and which is correct for the type of cell with which it is used, the bell on the battery box will ring. This is a signal to release the valve. With this apparatus a battery can be quickly and accurately filled without special examination of the cells. The filler can be obtained from the Edison company.

In addition to insuring the correct height of the electrolyte the filler will indicate other conditions. Should the bell not ring when the cell is filled to height, this will be an indication of a weak solution, or the solution is so low in the cell that the fresh water added could not become mixed with it and have the required specific gravity. In the event of the bell not being in adjustment or the dry cell battery exhausted, the signal will not be given, and for that reason the filler should be tested before it is used by making a connection with any piece of metal between the steel nozzle and the metal sleeve surrounding it. This precaution will insure that the filler is in good order and will function accurately.

In making hydrometer readings of the electrolyte the battery man should bear in mind that the statements that have been made relative to specific gravity are based on a temperature standard of 65 degrees Fahrenheit, and that there is some variation in specific gravities when the temperature of the electrolyte is lower or higher than this standard. Generally speaking there will be an increase of two points in specific gravity with every 10 points decrease in temperature, or vice versa, and with a standard or normal solution the maximum and minimum for efficient service may be indicated by the following tabulation:

Solution Temperature	Limits of Specific Gravity Maximum	Minimum
100	1.192	1.152
90	1.194	1.154
80	1.196	1.156
70	1.198	1.158
60	1.200	1.160
50	1.202	1.162
40	1.204	1.164

While considerable variation in the specific gravity of the electrolyte is permissible and a weak electrolyte will temporarily impair the efficiency of a battery, especially at low temperatures, but there will be no permanent deterioration. Specific gravity readings should always be taken at the conclusion or near the end of a charge, for the gassing will have caused circulation and a uniform mixture.

Specific gravity, however, is not always a true indication of the value of the electrolyte, as, when the water used for flushing or equalizing contains carbon dioxide or other impurities, salts may be formed which, while maintaining the specific gravity, are useless or even damaging as electrolyte. This condition would necessitate renewal of the solution.

The renewal of the solution does not require experience, but does require care to prevent contamination of the liquid. The battery should be completely discharged before filling, and then the cells should be removed from the crates. Half the content of the cell should be poured from the filler opening. Then the filler cap should be closed and the cell shaken vigorously so as to insure that any material that may have found its way into the container is dislodged and sus-

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pended in the solution. The cell can then be emptied.

In placing the renewal solution in the cell it may be drawn from the steel drum in which it is received and poured into the cells, using a clean glass or enamelled ware funnel, but a better way is to siphon it direct from the drum into the cell with a clean section of rubber tube, which will the better protect it against dust or foreign matter. Where practical, the drum may be elevated and the cells may be filled from it by gravity.

Under no circumstances should the apparatus used for filling the cells with water be used for renewing the electrolyte.

No acid should be introduced into Edison cells, and utensils that have been used with acid should not be utilized, for the cell may be seriously damaged by acid. Where other types of batteries are in service the apparatus and utensils intended for Edison cells should be kept separate or labeled so that they will not be used for any others.

The flushing or equalizing of the cells should be done before charging, as this will insure a thorough mixing of the water with the solution and a better efficiency of the battery.

(To Be Continued.)

LEE NORTON RESIGNS.

Lee Norton, vice president and general manager of the J. I. Case Threshing Machine Company of Racine, Wis., who has been connected with the company for 26 years, has resigned and has retired to his farm.

CENTRAL STATIONS PUSH TRUCK SALES.

The campaign of the electric central stations to push the sale of electric trucks, which has been arranged by the electrical interest, is on in earnest. Recently in Hartford, Conn., a two-ton electric truck of the Hartford Electric Light Company gave a demonstration through the centre of the city, hauling a two-ton trailer with both vehicles loaded heavily with electric cable. The Hartford company's electric truck sales department has been organized for several years and is directed by Manager Willis M. Thayer. This company is an active agent for the sale of electric trucks and has been very successful in placing machines with Hartford business men. This company originated the first battery exchange service in America, which has proven to be very successful.

FOSS IS PIERCE-ARROW HEAD.

W. J. Foss, for 10 years treasurer of the Foss-Hughes Company, agent for the Pierce-Arrow Motor Car Company, with offices and salesrooms in Philadelphia, Baltimore, Washington, Providence, Newport, R. I., and Wilmington, Del., has been made commercial manager of the Pierce-Arrow company, an office newly created by its board of directors.

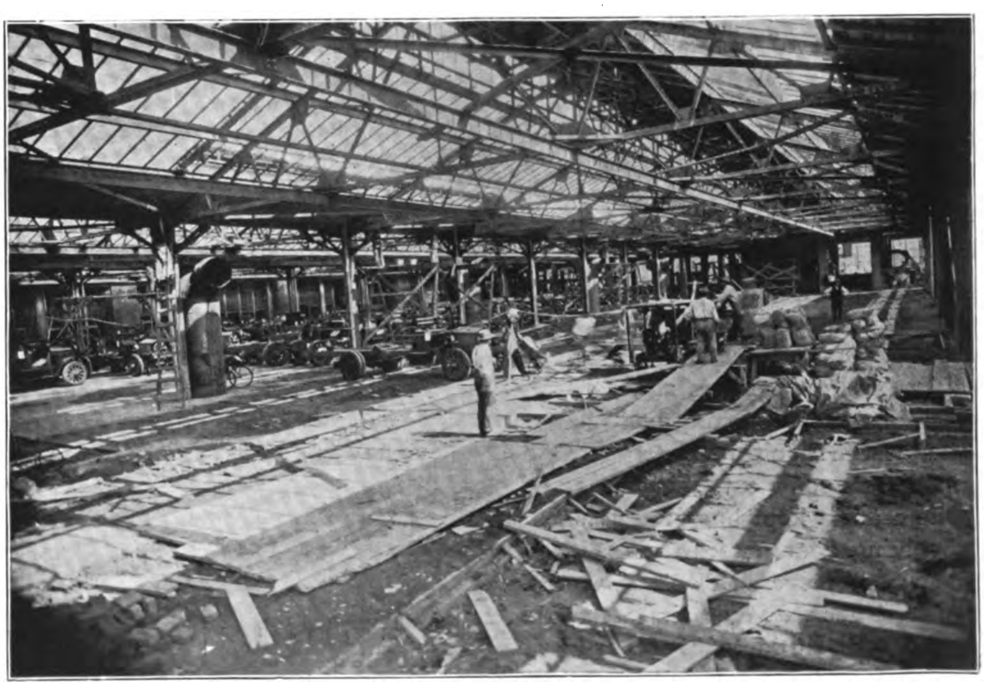
Mr. Foss will be the direct executive of every commercial activity of the company and will have absolute authority over all sales of pleasure cars and trucks, advertising, publicity and service, and all of these department heads will be under his supervision. He will be associated with Col. Charles Clifton, treasurer of the company, who is also chairman of the executive committee and a director. Mr. Foss has been a large factor in the industry and his new association is expected to greatly promote the interests of the Pierce-Arrow company commercially.

USE UNFINISHED PACKARD BUILDING.

So pushed is the Packard Motor Car Company for space in which to build the large number of trucks that are required to fill its foreign and domestic orders that it has been necessary to use the new truck construction building before the workmen had finished with it.

One hundred trucks were run into the structure for the final work upon them, while the glaziers and painters were still working on the roof and a concrete mixer was still busy laying one-half of the floor, as shown in the accompanying illustration.

As each section of the floor hardened sufficiently to bear the weight of a truck it was put into use.



New Truck Construction Shop of the Packard Motor Car Company, Which Was Occupied While the Erection Was in Progress.

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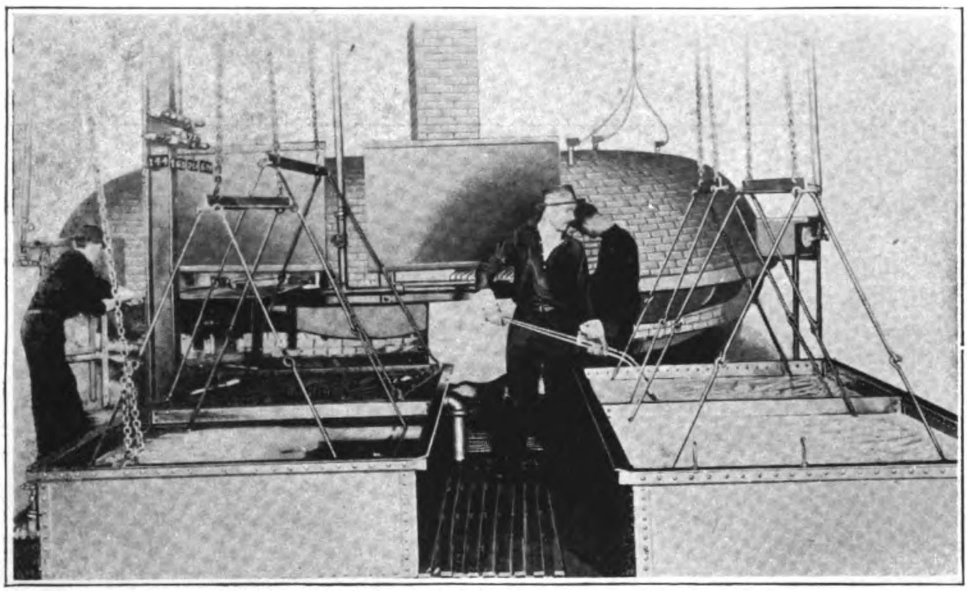
NEW HEAT-TREATING SYSTEM.

Rotary Furnace Has Higher Efficiency and Much Greater Capacity.

A new type of heat treating furnace designed and built by the engineers of the Detroit Steel Products Company, Detroit, Mich., has greatly simplified the process of tempering automobile springs, increased the volume of work possible and improved the accuracy of the work.

The exterior of the furnace resembles a great mushroom 25 feet in diameter. Inside this shell is a revolving floor, operated by an electric motor, which makes one turn every 20 to 30 minutes.

Through openings in the sides of the furnace jets of fuel oil and air play into it and are ignited by contact with the heat inside. Heat is kept even at a temperature of from 1450 to 1575 degrees. Ten pyrometer couples register the temperature and on an electric signal board notify the operators when the temperature threatens to become too high or too low.



Mammoth Oil Burning, Heat Treating Rotary Furnace Just Installed in the Plant of the Detroit Steel Products Company for Tempering Vehicle Springs.

In the old type furnace it was necessary to heat the furnace to a considerably higher temperature than was desired for the springs, which were heated rapidly and removed before they became too hot. The new furnace is heated to the exact temperature required for the springs and they are heated slowly.

There is no opening and closing of doors to make the heat difficult to control. One small permanent opening is sufficient. Seven men operate this furnace. One crew is kept busy removing heated plates as the revolving floor passes the opening, and the other inserts new leaves. This furnace treats 50,000 pounds of steel a day, seven times the old furnace capacity.

One revolution of the floor in the furnace is necessary to do the work and the springs are then placed in oil baths, which are kept at a temperature of from 90 to 120 degrees. From the baths the oil goes to submerged tanks under the building and is then taken to the roof by an elaborate system of pipes which have two compartments, one for the hot oil and one for cold water. After passing through the pipes the oil is returned to the baths at the temperature required.

After leaving the baths the springs which have been treated in the rotary furnaces go into draw furnaces. They pass through these on a rotary conveyor for 30 minutes at a maximum temperature of 900 degrees Fahrenheit, so that the hardness is modified to give them the necessary tensile strength.

TRUCKS WANTED IN HONDURAS.

Orders for two five-ton trucks to carry merchandise from the coast to Teguciagalpa, Honduras, have been placed in America and Consul E. M. Lawton has reported that there are about six additional firms whose business is large enough to warrant their operating trucks. All goods are now carried from the coast to the town by ox carts, which are loaded with 2000 pounds and take eight days to cover the outward trip of 88 miles. For the service the carters receive from 75 cents to $2 a hundred pounds of freight, according to condition of the roads and the scarcity of forage.

The entire 88 miles of road is good macadam, except about 10 miles at the sea level end, which is muddy and heavy during the five months of rainy season. The road goes over a gradual grade to 5000 feet above sea level and then gradually drops to 3200 feet. The grades through the hills are at no point greater than nine per cent. Gasoline sells for 50 cents a gallon. Chauffeurs receive $100 a month and are foreigners, while native helpers are paid $30 a month.

HYATT OFFERS $1000 IN GOLD.

"How far has your car run on Hyatt quiet bearings?" is the question propounded by the Hyatt Roller Bearing Company in the endeavor to obtain a wide variety of engineering data for its library. The company is willing to pay $1000 for the information, the money to be distributed as prizes for the best answers as follows: First, $500; second, $200; third, $100; fourth, $50; fifth, $30; sixth, $20; next 10, $10 each.

The official entry form, which each contestant for prizes must have, can be obtained from the company, at 700 Woodward avenue, Detroit, Mich. The contest closes Nov. 1.

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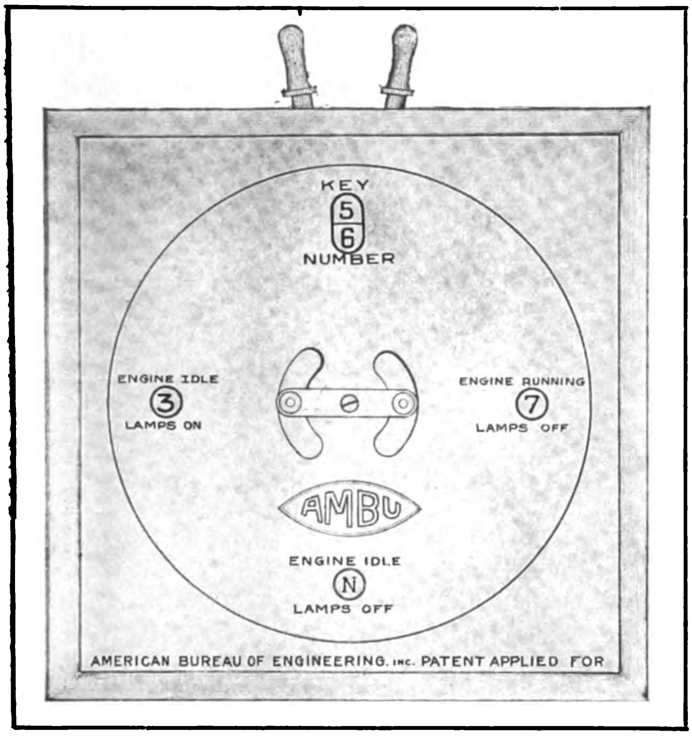
THE AMBU ELECTRICAL TROUBLE SHOOTER.

UPWARDS of 30 electrical systems for starting engines and lighting vehicles, some of which include ignition, to say nothing of the equipment that is either designed for engine starting or lighting, are



The Indicating Dial of the Ambu Electrical Trouble Shooter for Engine Starting Lighting Systems.

manufactured commercially in America and are included in the equipment of a very large proportion of the automobile cars and trucks built. These systems are made in one, two, three or even a greater number of types, and the total is constantly being added to. Not only this, a single type, for instance, may be dif ferently installed on each make or even model of vehicle, the units being located and the wiring put in to best serve convenience or expediency. Statement is made that in the simplest of these systems as many as 250 different defects may be developed in service.

What complication may arise in these systems while in use cannot be predicted. The repairer who specializes work on all makes and types of machines must know the manner of installation and the detail of each system to qualify him to make adjustment and restoration satisfactory to his customers and profitable to himself. Such knowledge can only be obtained from special study or experience. The average garage electrician can only obtain the experience in a long period of time, and then only on such work as may come to him. To engage an electrical specialist would be impossible unless there was a certainty of continuous use for his services.

System Covers Every Equipment.

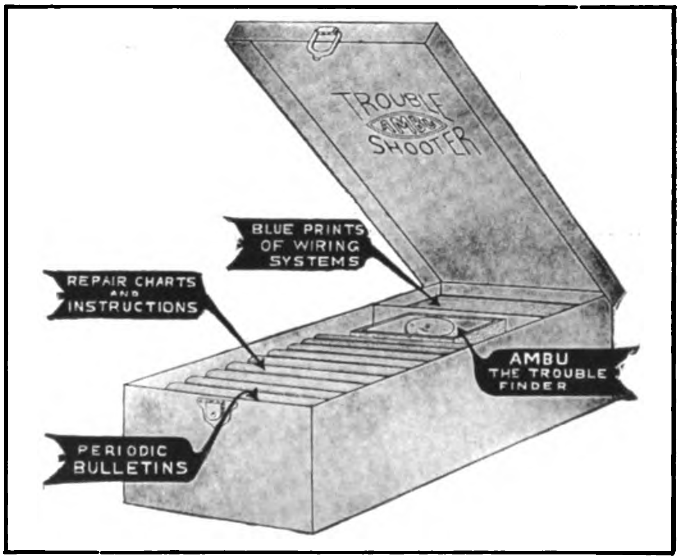
The garages, public service stations and even those who give this work special attention have men who are intelligent and well informed, but their knowledge cannot keep pace with the development of the systems or the changes made, and at best they can only determine conditions by processes of elimination. In small cities and towns expert electrical service is of extreme importance to the garage or the repairer's customers, because the advice of factory experts is not often obtainable. Inability to do work means actual loss of patronage and the diminished confidence of customers.

To meet the condition that is obvious the American Bureau of Engineering, 1018-24 Wabash avenue, Chicago, Ill., has developed for the use of electrical repairers a device that is known as the Ambu Electrical Trouble Shooter, with which any of the very numerous defects or causes of failure of any of the electric starting and lighting systems can quickly be determined, so that with directions, charts and diagrams the workman can make a complete adjustment or restoration. Highly trained electrical experts are unnecessary.

Some of the Makes of Installations.

In developing this system a careful study has been made of the construction and installation of the different equipments made by the following: Adlake, Auto-Lite, Bijur, Bosch, Briggs, Deacon, Delco, Disco, Dyneto, Entz, Easterline, Garford, Gray & Davis, Hartford, Jesco, Leece-Neville, National, Northeast, Remy, Rushmore, Simms-Huff, Splitdorf-Apelco, U. S. L., Vesta, Ward-Leonard, Wagner, Wells, Westinghouse, as well as others.

The indicating unit is a patented instrument having a glass covered dial, with two levers by which it may be set for use on any vehicle, the indicators serving as an index to more than 700 cards and charts



The Manner of Indexing the Cards, Charts and Diagrams for the Reference of the Repairer.

which describe the fault or failure and the means of repairing it.

In the use of this instrument, if a machine is

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brought to a shop for a repair of an electric system, the repairer learns the make and model, and in the index finds the code number assigned to it. For illustration, the designation will be assumed to be "5-6." With the levers the instrument is set so that the code numbers appear at the top of the indicator, the figure 5 appearing above the figure 6. One of the battery cables is disconnected wherever convenient and one of the large cables of the instrument is attached to the battery and the other to the free end of the battery cable. The cables are such length that the indicator can be placed conveniently for observation.

With the engine idle and the lamp circuit open the repairer notes the indicator at the bottom of the dial, which is marked "Engine Idle and Lamps Turned Off." If there is fault there a number will appear in this indicator. Having this number the repairer refers to an indexed box of cards and charts and selects the card marked in the section devoted to that car under those conditions. He finds a description of the condition and complete directions for restoration.

Next he closes the lamp circuit with the engine idle and notes the indicator that is marked for that condition. Having the number he again refers to the card index for a description of the cause of failure and the necessary repair. He then makes another test with the engine running and the lamps in circuit, and consults the index. When he has completed the work required by the directions the electrical equipment ought to be thoroughly operative.

How Time Is Economized.

A man experienced in electrical work could do with voltmeters, ammeters or volt ammeters a part of the testing automatically done with the Ambu Trouble Shooter, but these instruments can only be used for some of the tests, and they cannot be located in the circuits so as to afford the most satisfactory results. The ammeters of the equipment may be possible sources of trouble and are not dependable for the very accurate indications necessary in making repairs of these systems. Without the Ambu instrument the repairer must know the exact voltage and amperage for each system and installation in different operating conditions, where to attach the ammeter or voltmeter to test each installation, and how to determine the fault that is indicated, and he must also work on machines where the ordinary meter cannot be used.

In using the Ambu system the repairer does not depend upon experience and judgment. He consults the instrument, refers to the index and follows directions. With this system an expert electrician will save very valuable time with practically every work. The instrument itself will last for years. For the owner of the private passenger car, or the operator of a fleet of trucks or delivery wagons having electrical equipment, the Ambu Trouble Shooter is as useful and economical as it is for the repairer. With it the drivers or mechanics can do work that is now sent to the electrical expert. In this system blue prints of wiring systems and instruction cards relate to every proportion of the electric equipment in service. For example, under Bijur is described the installation of those systems in Packard, Hupmobile, Jeffery, Knox, Apperson, Scripps-Booth, Winton and Russell-Knight vehicles.

The Ambu system is sold for a moderate price, which includes all service for a year, so that when changes are made in any equipment the owner of the instrument is notified and supplied with correction cards. The correction cards describe both the old and the new equipment, so the old cards can be filed or thrown away. Service letters are also sent, so that a repairer has more specific advice in the improbable event that the original information was not sufficiently definite. The simplicity and practicability of the Ambu system recommends it to any garage or repairer.

PAPERS FOR E. V. A. MEETING.

Some very interesting subjects have been assigned for papers to be read before the sixth annual convention of the Electric Vehicle Association of America at Cleveland, O., Oct. 18 and 19. Among the papers that will be presented will be: "Industrial Trucks in the Service of the Pennsylvania Railroad Company," by T. V. Buckwalter of the Pennsylvania railroad; "The Electric Taxi-Cab," by I. S. Scrimger, secretary and general manager of the Detroit Taxi-Cab Company; "The Hartford Electric Company's Experience with Battery Maintenance and the Battery Exchange System," by Samuel Ferguson, vice president of the Hartford Electric Light Company; "The Function of the Electric Garage," by R. Macrea of the Commonwealth Edison Company, Chicago, Ill.; "Comparative Development of General Power and Commercial Vehicle Loads and the Function of Power Salesmen as Electric Vehicle Solicitors," by Messrs. H. H. Holding, general power representative, and S. G. Thompson, general electric vehicle representative of Public Service Electric Company of New Jersey; "Problems We Are Facing and How They Can Be Met," by George H. Kelly, secretary of the Baker-Rauch & Lang Company, and president of the Electric Vehicle Manufacturers' Association; "The Field for the Small Electric Delivery Vehicle," by Charles A. Ward, secretary and treasurer of the Ward Motor Vehicle Company, Mount Vernon, N. Y.; "Electric Vehicles in Municipal Service," by Arthur J. Slade, consulting engineer of New York City.

CLAIMS FRONT WHEEL DRIVE PATENTS.

Claiming to hold front wheel drive patents which cover the use of a universal joint in proximity to the pivoted parts of a steering knuckle, John W. Moakler of East Worcester, N. Y., has issued a patent notice which will probably mean litigation for the makers of front wheel drive and four-wheel drive motor trucks.

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PRACTICAL MOTOR TRUCK MECHANICS.

On certain types of spark plugs, sooting can be easily prevented if the electrodes are bent, as illustrated in Fig. 34 A. When the plug is of the type

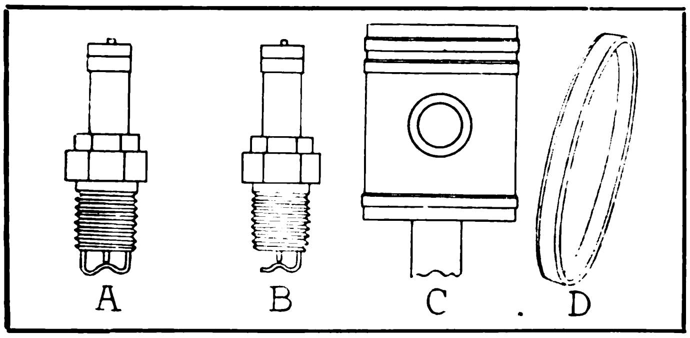

Fig. 34—A, Centre of Shell Electrode Bent to Prevent Sooting; A, Electrode Cut Away to Insure Against Fouling; C, Piston Ring Adapted to Prevent Excess Oil Being Carried to Combustion Chamber.

shown at A, the shell electrode can be slightly bent upwards in the centre at the point marked X. If adjustment cannot now be made with the central electrode it can be removed and a portion filed off. When assembled as shown, the contact point being elevated has the advantage of allowing the oil to drain away. A similar bend can be made on a plug of the type shown at Fig. 34 B. It will also be necessary to file the central electrode so as to permit an adjustment.

OIL IN THE COMBUSTION CHAMBER.

A smoky exhaust is usually the result of the presence of oil in the combustion chamber at the time of ignition. When this cannot be remedied by fitting new piston rings, lowering the oil level, or using a heavier oil, the remedy shown in Fig. 34 C will usually prove effective. Remove the piston rings and with a fine file carefully round the top edges. The bottom edges should not be filed, however. The result of this is that the rounded edges do not have a tendency to carry the lubricant up into the combustion chamber. On the downward stroke of the piston, however, the sharp lower edge of the rings carry the oil back into the crank case, thus ridding the cylinder of the excess of oil.

EFFECT OF EXCESS AIR ON MIXTURE.

A very satisfactory quality apparent in the new car is the ability to throttle down to a few miles an hour when in high speed and then almost instantly and always smoothly to resume the original speed. As the car grows older, however, the action frequently becomes jerky, in which case the car owner is prone to condemn the carburetor. This part, however, is not always at fault.

The smooth action of the new car is usually due to the fact that the fuel mixture was received in the combustion chamber in correct proportion. With constant use gradual wear takes place at the point of contact between valve stem and guide. As the mixture is drawn into the cylinder by the suction of the piston, that suction also draws on excess of air through the apertures left by the worn guide, as shown in the illustration at Fig. 35 A. The amount of air thus drawn in varies in volume and consequently prevents making adjustment of the carburetor that will give satisfactory results.

Sometimes air is drawn in through loose manifold joints, or through loosely fitted spark plugs, or pet cocks, as indicated by the arrows in the illustration at Fig. 35 B.

The remedy for the condition due to worn guide is to replace the bushings, if possible; if not practicable, the guide must be fitted with some kind of an adjustable stuffing box, several types of which are to be found on the market. It is unnecessary to pack the exhaust valve guide, as that valve is closed when the mixture is admitted. Manifold joints can be tightened by coating both sides of the gasket with shellac. The threads of the spark plug and priming cocks should be coated with graphite.

SAFE STARTING.

The compression of the motor of large trucks is sometimes so great that the driver must use both hands to turn the motor over. If the ignition switch is turned on this practise is very dangerous, because should the motor back fire, the person cranking the motor has no possible chance of avoiding the flying crank handle. Most large trucks are equipped with a battery and a press button starting system on the switch. If the truck is so equipped the safest way is always best.

The carburetor may be flooded if desired and the

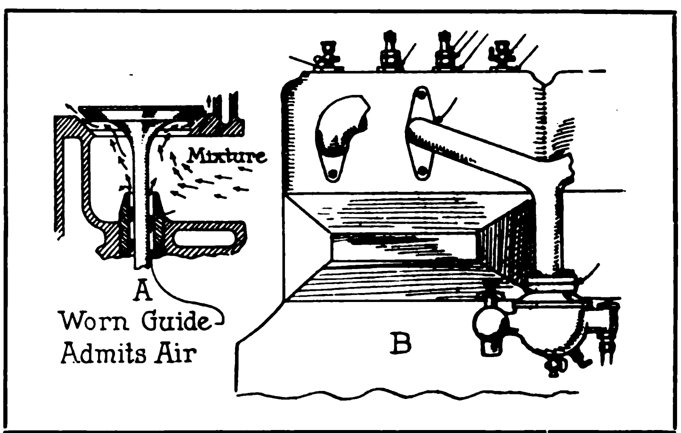

Fig. 35—A, Fuel Gas Diluted by Air Admitted Through Worn Valve Stem Guide; B, Air Leaks About Spark Plugs and Intake Manifold.

throttle left wide open. With the ignition switch turned "off" the motor should be turned over with the crank a few times so as to draw a full charge of gas

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into the cylinders. After doing this the press button should be worked rapidly, with the switch turned "On," thus igniting the compressed gas and starting

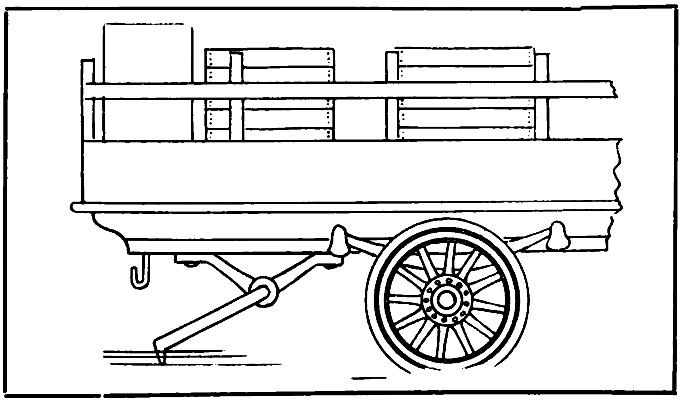

Fig. 36—Sprag Adapted for Use with Heavy Trucks to Insure Safety While Climbing Heavy Grades.

the motor without the use of the crank.

If there is no press button on the switch, the same suggestion will apply for first drawing gas into the cylinders. When the switch is thrown on one sharp turn of the motor will ignite the charge, so that the danger of accident from spinning is avoided.

WAGON SPRAG FOR TRUCKS.

Heavy trucks while climbing hills can be made absolutely secure from sliding back in case of accident, or uneven gripping of the brakes, if a sprag similar to that used on heavy wagons be fitted to the rear. It consists of a V shaped hanger, which is securely bolted to the chassis, and a movable arm attached to the hanger, as illustrated in Fig. 36. When not in use the arm can be raised and hooked to the frame.

REPAIR OF A CRACKED MANIFOLD.

Chewing gum and a handkerchief are sufficient in some cases for an effective temporary repair to a cracked manifold. Such accidents are of frequent occurrence on some two-cylinder motors that have brass intake manifolds. The break is hard to locate usually, but can be detected by applying kerosene oil around the joint, which will be sucked in at the point of break and thus indicates its location. If electric tape is not at hand, a well masticated piece of chewing gum can be applied to the break and held in place by a tightly bound handkerchief, as shown at Fig. 37 A in the illustration. A repair made with tape is shown at B.

OIL GROOVES.

Plain bearings are made of babbitt, brass, bronze, and in rare instances, of cast iron. They are to be found in great numbers in the earlier types of cars, although they have been replaced in most of the later models by roller and ball bearings. Plain bearings are exceptionally difficult to keep well lubricated, unless the proper types of grooves are cut. The diagram illustrates grooves that will insure ample lubrication. A small hole is drilled through the centre of the split bearing and small grooves should be cut into the surface of the metal with a small draw chisel. The grooves should lead to the different corners, but should not break through. The burred edges can be smoothed with a round file. The bearing after the oil grooves have been cut is illustrated at Fig. 37 B.

REPAIRING CRACKED FRAMES.

The only proper method of repairing a cracked frame is to have it welded. If, however, the motorist should have the misfortune to be in a section of the country where it is impossible to have the frame welded, a suitable repair can be made as follows: Shape a piece of steel, which is a trifle thicker than the frame, so shaped that it will fit into the frame and extend for at least six inches on either side of the crack, as shown in the illustration. Several ⅜-inch holes should then be drilled through the piece and frame and hot rivets firmly positioned by sharp blows with a hammer. The operation is illustrated at Fig. 38 A.

STRAIGHTENING FRAMES.

Although a bent channel steel automobile frame can often be straightened while cold, it is considered the better practise to first heat the metal. A blow torch will generally serve this purpose. A length of wood should then be placed at the end of the frame, as illustrated, and a closed jack at the other end, the head

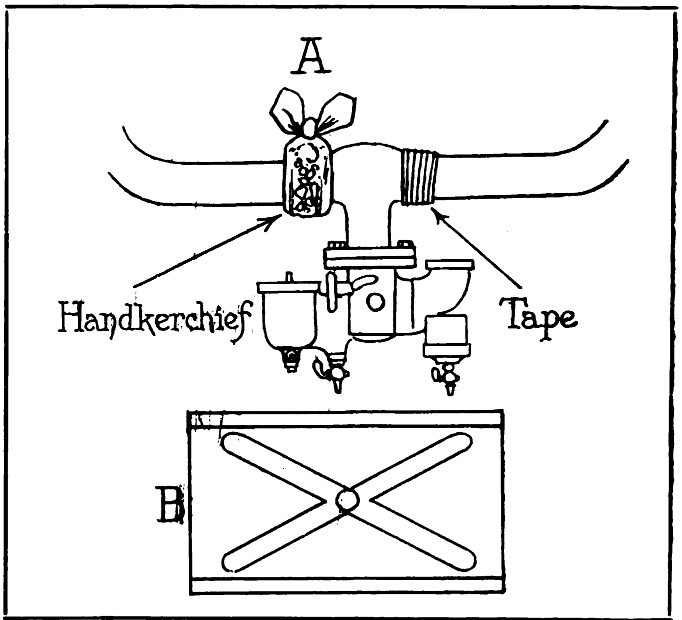

Fig. 37—A, Emergency Repair of a Cracked Manifold; B, Illustrating How Oil Grooves Should Be Cut to Insure Better Lubrication of Plain Bearings.

just touching the end of the bent section. As the metal becomes hot the jack can be let out a little at a time until the frame is fully straightened. This method is

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better than hammering, as the action is gradual and the danger of cracking the metal is greatly reduced. It is obvious that where conditions will permit, the more

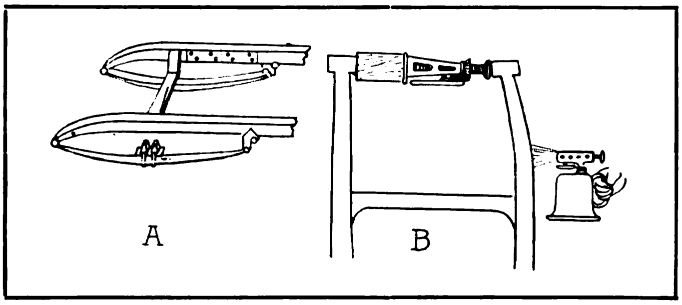

Fig. 38—A, Repairing Cracked Frame; B, Straightening Bent Frame with Jack and Blow Torch.

metal allowed on either side of the crack, the stronger the repair. This work is shown at Fig. 38 B.

HOW TO REMOVE DENT FROM HORN.

Of the several methods for removing a dent from an automobile horn, the following simple suggestion is made. Make a loop in a strong brass wire, and bend the loop at right angles. Solder it to the dented part of the horn, as shown at Fig. 39 A. When the solder has set, place the other end of the wire in a vise and by giving a few firm jerks to the horn the depressed part will be pulled up. The wire can be removed by melting the solder.

HOME MADE JACK.

The automobile jack illustrated in Fig. 39 D-E, can be easily made from spare pipe fittings to be found in almost any shop. To a piece of one-inch pipe, about 10 inches in length, screw on a flange, D, to serve as a base. Within the pipe, H, insert a ½-inch pipe, I, that is 12 inches long. This should be threaded for its entire length and a cap fitted to the lower end. A bar of iron, J, 15 inches in length, one-quarter inch thick, and 1¼ inches in width is shaped as shown, and a hole sufficiently large to admit the pipe I is drilled at the end. Cut a number of slots in periphery of a small flange, as shown at K. The centre of the flange should be bored and threaded to fit the pipe I. The flange is then screwed down on the pipe, I, until it rests on the pipe H. The bar J then fits over the flange and a hook attachment, which is secured to the end of the bar, insures its relation with the flange. A pawl, L, is then made from ½x¼-inch steel stock about eight inches long. This is secured to the centre of the bar J by a machine screw. At the top of the pipe I, a jack head is made by sawing a pipe tee in two. The action of the jack is obvious, as it is possible to swing the pawl on its axis to engage the notches in the flange at either side of the bar J.

PROPER HEAT FOR BABBITT.

A mistake frequently made is heating babbitt metal to a temperature too high for the making of good bearings. The correct temperature of babbitt for pouring is reached when the metal will ignite a small pine stick. If the metal is brought to a red heat it becomes brittle and hard when cool and readily breaks. It is a poor practise to mix overheated metal with new, as the result will not be satisfactory, the cast being brittle.

PREVENTING HOSE FROM KINKING.

If the greatest of care is not taken when fitting rubber hose between the radiator and the cylinders, there is danger of it kinking at the point of bend. A simple remedy that will positively prevent this is shown at Fig. 39 B. From a length of 3/32-inch brass wire, wind a spiral spring, making about three windings to the inch. The diameter of the spring should be such that it will snugly fit the inside of the hose. The ends of the spring should then be bent inwards to prevent them from puncturing the rubber. Fig. 39 C illustrates the assembled device.

FOOT ATTACHMENT FOR JACK.

Raising heavy cars with the ordinary hand operated jack is a strenuous operation that is avoided when possible by the driver. A much easier method of operating a jack for such work is shown in Fig. 39 F-G. A foot stirrup is riveted to the jack handle. This can be made by shaping a piece of sheet steel, shown at G, and cutting two slots at the ends so as to admit a strap. This can be adjusted to fit the foot snugly by tightening or loosening the strap as desired. It is obvious that this fitting will afford greater leverage than can be obtained with the hand, and it is a convenience that can be appreciated by every man who handles a jack.

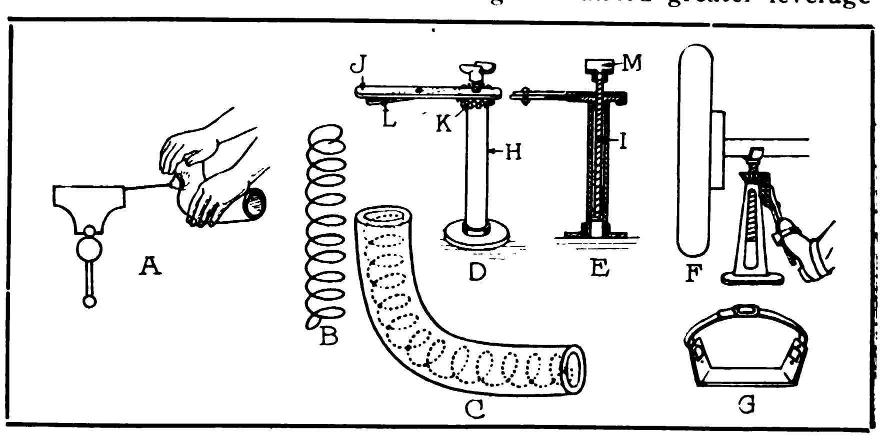

Fig. 39—A, Removing Dent from Horn; B-C, Preventing Hose from Kinking; D-E, Home Made Jack; F-G, Foot Attachment for Jack.

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STORE SUPPLY SERVICE.

Wholesale Distribution from Motor Truck to Shoe Retailers and Repairers.

A decidedly unusual use is made of a model F 2000-pound capacity International motor truck by Norman F. Shaffer & Co., 606 Laurel avenue, Chicago, Ill., a wholesale dealer in leather findings and shoe store supplies. This company for years confined its activities to Chicago, but occasionally sold to customers in the suburbs and in towns adjacent to that city. The suburban sales were generally mail or personal orders, which of necessity were shipped by express or parcel post, some time being required for delivery after the orders were received.

The possibilities of dealing direct with these customers and developing a much larger custom were sufficiently promising to justify the purchase of the chassis, which was equipped with a special body to carry a complete stock of goods from which the driver, who is the salesman, can make immediate delivery. This body, as may be judged from the accompanying photograph, was designed so that the stock carried may be instantly accessible, and a large quantity can be carried. The body in general appearance is full panel in design, but differs with the conventional type in a number of essentials.

The loading section is unusually long and at the forward ends at either side are wide doors that raise and lower, being divided in the centre. So that the bottom halves of the doors may be dropped, to form shelves on which to place goods for examination. The forward ends of the rear mudguards are hinged and can be lifted out of the way of the lower halves of the doors as they are lowered. The rear doors of the body are similar in design. Five shelves, accessible by the side doors, extend the full width of the body. At either side of the rear compartment are five shelves, extending to the cross shelves. All the shelves are equidistant apart. Between the rear compartment shelves is a space for storage the full height of the body.

The stock can be carried in packages or boxes that can be snugly stowed on the shelves and in the central space between them, and these can be conveniently reached by the salesman without unpacking and repacking the goods at each stop. The body is solidly built and can be loaded to the weight capacity. The driver's cab is fully enclosed, having a full height door at the left side, with oval windows in the doors, the side panels and the rear partition of the compartment, so the driver has unusual range of vision from his seat and can see the interior of the body by turning. At the front, above the dash, is an adjustable window or windshield. This truck is sent as far south as Hammond, Ind., and to Chicago Heights, as far west as Aurora, and north to Niles Center, making trips at regular intervals. The head of the firm operating the truck states that the service is giving excellent satisfaction, for the customers know they can obtain stock of their own selection on given dates, and in whatever quantities desired, and prefer this manner of purchasing to any other. With the truck much business otherwise unobtainable has been developed.

International Model F Truck Equipped for the Distribution of Stock by Chicago Dealer in Shoe Findings to Suburban Trade.

CAN'T PREVENT USE OF ROADS.

A member of the Motor Truck Club of New York, who was forbidden by the town superintendents of highways in two towns to use his 3½-ton milk truck over the highways of those towns, has been advised by the legal counsel of the club to ignore the notices on the ground that the superintendents had exceeded their authority. The operation of the truck was continued and no steps were taken to prevent its use.

TO DRAW NEW YORK SHOW SPACE.

The drawing for space at the New York automobile show will take place at the New York office of the National Automobile Chamber of Commerce Thursday, Oct. 7, the members of the organization drawing in the morning and non-members in the afternoon. This was decided on at the last meeting of the chamber.

A memorial resolution was passed at that time on the death of S. T. Davis, Jr., president of the Locomobile Company of America. The chamber decided, as a result of the service managers' convention, to organize local bodies of service managers at Detroit, Chicago and Cleveland. One body has already been organized in Indianapolis.

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TRUCK OPERATES PRINTING PRESS.

During the tropical storm which recently inundated and devastated Texas coast towns, Galveston was flooded and both the electric light and gas systems were put out of commission. The newspapers depending on electric power to get out their editions could not print. But a pressman in the Galveston Tribune's plant got the idea of jacking the rear end of a Wichita truck and attaching a belt to the rear wheels. This was done and the first edition of any newspaper to come out after the storm was run off. The truck itself had been under water and it was remarkable that it should have been in condition to run the press.

FEDERAL LUMBER TRUCK RECORD.

The Federal Motor Truck Company, which has attached tape service recorders to many of the trucks of its customers, recently completed an analysis of the work of a Federal truck used by the Sterling Lumber and Supply Company of Chicago.

This showed a daily average number of stops of 6⅝; daily average trips, 2½; daily average mileage, 62.8; average per gallon of gasoline, 7.46 miles. On seven days during the month in which the record was taken, the truck made runs from Chicago to Michigan City, Ind., and return on the same day—a distance of more than 116 miles.

MOTOR TRUCK CLUB'S OUTING.

The annual outing of the Motor Truck Club of New York City was held Sept. 18. A steamer that left the foot of East 42nd street conveyed a large number of members and their guests to Duer's pavilion, at Whitestone landing, on Long Island. Music, dancing, sports and bathing were the principal amusements of the occasion, which was planned for a date after Labor Day, so that all the members would have returned from their vacations and be free to enjoy it. The committee of arrangements consisted of T. D. Pratt, F. N. Carle, H. P. Cavarly, Roderick Stevens, George H. Duck, W. C. Andrews, R. D. Dumont, Joseph Husson and M. C. Horine.

PACKARD GETS MATERIAL BY EXPRESS.

In its effort to rush to its factory material, which is needed to meet the large increase in production this year, the Packard Motor Car Company is using express shipments liberally. Two Adams express cars drawn by a special locomotive arrived at the factory recently with steel from Reading, Penn.

All employees of the Goodyear Tire and Rubber Company, Akron, O., who are members of the National Guard, receive full pay while they are on duty. A large number of them participated in the camp and manoeuvres recently held at Yellow Spring, O.

FIRE CHIEFS TEST ENGINES.

Efficiency of Motor Equipment Demonstrated at Cincinnati.

It was fitting that in Cincinnati, the city in which the first steam fire engine was built and where the first paid fire department was established in America, that the gasoline fire engine should prove its efficiency so conclusively that the most conservative fire chief cannot doubt it.

One of the principal events of the annual convention of the International Association of Fire Engineers was the test of gasoline pumping engines under the most rigid conditions—much more trying than any that are likely to be found in actual fire fighting.

Providence, R. I., was chosen as the place for the convention next year and the following officers of the association were elected: Harry L. Marston, Brockton, Mass., president; T. A. Clancy, Milwaukee, Wis., first vice president; A. A. Rozetta, Nashville, Tenn., second vice president; James McFall, Roanoke, Va., secretary, and George Knofflock, Mansfield, O., treasurer.

In the tests of pumping engines the different apparatus were rated at different capacities at 120 pounds pressure, 200 pounds pressure and 250 pounds pressure. The test ran for six hours at 120 pounds pressure and three hours each at 200 pounds and 250 pounds. The results were as follows:

Ahrens-Fox engine 803, rated at 700 gallons at 120 pounds, showed 747 gallons at 133 pounds; rated at 350 gallons at 200 pounds, it showed 385 gallons at 217 pounds; rated at 250 gallons at 250 pounds, it showed 273 gallons at 264 pounds.

Ahrens-Fox engine 701, rated at 1100 gallons at 120 pounds, showed 1116 gallons at 131 pounds; rated at 550 gallons at 200 pounds, it showed 560 gallons at 239 pounds; rated at 450 gallons at 250 pounds, it showed 463 gallons at 274 pounds.

Seagrave engine 13,633, rated at 1100 gallons at 120 pounds, showed 1124 at 133 pounds; rated at 750 gallons at 200 pounds, it showed 765 gallons at 210 pounds; rated at 600 gallons at 250 pounds, it showed 618 gallons at 259 pounds.

Seagrave engine 13,541, rated at 800 gallons at 120 pounds, showed 800 gallons at 136 pounds; rated at 500 gallons at 200 pounds, it showed 506 gallons at 216 pounds; rated at 350 gallons at 250 pounds, it showed 382 gallons at 265 pounds.

Seagrave engine 13,222, rated at 500 gallons at 120 pounds, showed 537 gallons at 136 pounds; rated at 300 gallons at 200 pounds, it showed 339 gallons at 208 pounds; rated at 200 gallons at 250 pounds, it showed 233 gallons at 260 pounds.

American La France engine 948, rated at 500 gallons at 120 pounds, showed 513 gallons at 131 pounds; rated at 275 gallons at 200 pounds, it showed 292 gallons at 223 pounds; rated at 250 gallons at 250 pounds, it showed 265 gallons at 259.5 pounds.

American La France engine 949, rated at 900 gallons at 120 pounds, showed 928 gallons at 132 pounds; rated at 450 gallons at 200 pounds, it showed 477 gallons at 218 pounds; rated at 400 gallons at 250 pounds, it showed 419 gallons at 256 pounds.

Robinson engine 754, rated at 900 gallons at 120 pounds, showed 900 gallons at 120 pounds. This engine was shut down during the first test owing to the heating of a rear crank pin bearing in the pump.

Robinson engine 766, rated at 800 gallons at 120 pounds, showed 817 gallons at 130 pounds; rated at 500 gallons at 200 pounds, it showed 514 gallons at 220 pounds; rated at 350 gallons at 250 pounds, it showed 385 gallons at 276 pounds. Within 10 minutes of finishing the test the operator increased the pressure and the air dome of the pump was ruptured.

Five new buildings of steel sash construction of the most modern and fireproof type are being constructed at the Akron plant of the Goodyear Tire and Rubber Company, and when these are completed 2000 additional persons will be employed by the company.

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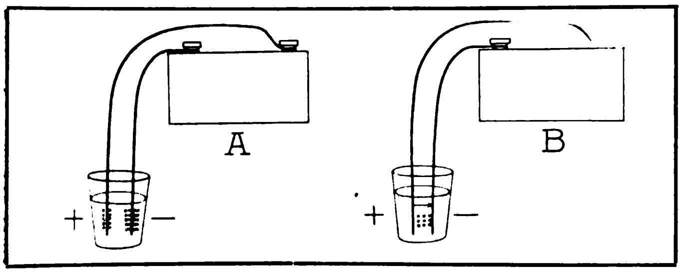
MECHANICAL QUERIES ANSWERED.

Determining the Poles—B. N. T., Westfield, Mass.

I have painted the box which encloses the storage battery and, through carelessness, I neglected to mark the different poles. Can you tell me of some test which will show the different poles?

There are several methods which may be successfully applied. One of the simplest, however, is as follows: Draw a small amount of electrolyte from the storage battery and place it in an ordinary drinking glass. Connect the wires to the different terminals of the battery and place the other ends of the wires, taking care that they are brightly polished, in the electrolyte in the glass. Holding the wires slightly apart it will be noted that minute bubbles will appear at both wires. A closer examination, however, will reveal that there are more bubbles at one wire than at the other. The greater number will indicate the negative pole. The reason for this is that the electricity in passing from pole to pole separates the constituents of the water.



Determining the Polarity of Electric Wiring by Dipping in Electrolyte

The chemical formula for water is H^2—O, that is, two parts of hydrogen and one part oxygen. These gases collect around the poles, hydrogen appearing at the negative and oxygen at the positive pole. If the wires are placed closely together in the electrolyte, it will be seen that the bubbles pass from one pole to the other, always leaving the positive or north pole and flowing to the negative or south pole. The accompanying illustrations show the results of the tests. If a voltmeter is at hand, the wires may be connected to the different terminals of the instrument. If the indicating finger registers the amount of voltage, it is certain that the positive wire is connected to the positive pole of the voltmeter.

Headlight Adjustment—J. L. B., Newcastle, Ind.

I recently secured electric headlights for my truck. One lamp seems to produce a stronger light than the other when they are tested separately. Both lights, however, seem to burn brightly, can you suggest what the trouble may be?

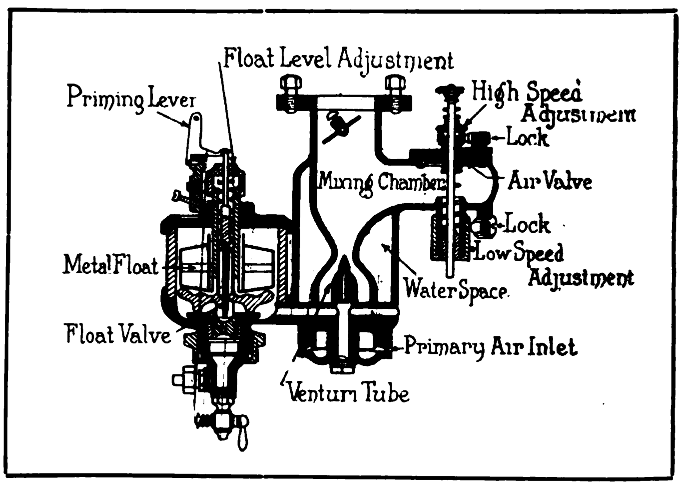
It would appear that one of the lamp bulbs is out of focus with the reflector, although I would suggest that you change the bulbs around to ascertain that the effect is the same. Modern electric lights are fitted with some means for adjustment, usually a screw at the back of the lamp. The reflector can be placed so as to project the light by tightening or loosening the screw. One can also well state that the lamps should be tilted slightly inward if the best results are to be obtained. This brings the rays of both lights together at a point distant from the machine and furnishes a powerful searchlight. This adjustment is shown in the accompanying illustration.

Model A Stromberg Adjustments—Subscriber, Middletown, Conn.

Will you explain the adjustment of the Stromberg model A carburetor? Has this carburetor a low and high-speed adjustment?

Stromberg carburetors are adjusted by the air valve, which is shown at the upper right of the accompanying illustration. The valve is mounted between two coil springs, the lower one being for low speeds and the upper one for high speeds. If the correct level is obtained it will be unnecessary to move any other part. Should, however, it be desired to examine the spray nozzle, remove the plug at the bottom of the mixing chamber and insert the blade of a small screw driver in the hole. The slot in the nozzle tip will be engaged and by turning to the left the nozzle will unscrew and drop down.

The first operation is to grip the small spring at the top and determine that there is about 1/32-inch play. If the spring is tight, turn the nut at the bottom of the spring to the right until the proper play is obtained. Now turn the small, round sleeve at the bottom of the air valve stem until the air valve drops from its seat. The sleeve should then be turned back until the valve slightly touches its seat, after which about three extra notches may be added. With the spark retarded the motor should now be started, the throttle being opened but little. The throttle lever can now be fully retarded and the adjustment nut at the bottom turned a notch at a time in either direction until the motor runs slowly and smoothly. This is the low speed adjustment.



The Means of Adjusting a Stromberg Model A Carburetor for Different Speeds.

With the spark advanced, quickly snap the fuel lever up and down. If the motor hesitates or there is a spitting noise, too much air is taken into the mixture

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and the small nut under the top spring should be turned up until the correct proportions are obtained. Should there be no spitting noise at the first sudden upthrow of the throttle, it is advisable to screw the small nut down until the noise is made and then back until it ceases. By this method the mixture may be thinned as fine as possible.

Care of Chains—N. M. J., Worcester, Mass.
What care should be given the driving chains of a truck if lengthy and satisfactory service is to be obtained?

No fixed rule can be applied to the care of chains and experience alone can teach the owner the degree of attention necessary. Load and road conditions are material factors. Usually long service can be obtained if the chains be removed from the chassis at the end of each week and soaked for 24 hours or more in kerosene, after which they should be placed in hot tallow and boiled, which insures that the lubricant penetrate to all joints. When the chains are attached to the car, graphited grease should be placed on the rolls.

Jerky Action with Second Gear—E. G. R., Trenton, N. J.
I own a six-cylinder touring chassis car converted for commercial haulage. I have recently experienced a trouble when the intermediate gear is engaged which I cannot locate. The action is jerky and there is considerable noise, not unlike there was a loose bearing. Can you advise me what the trouble might be?

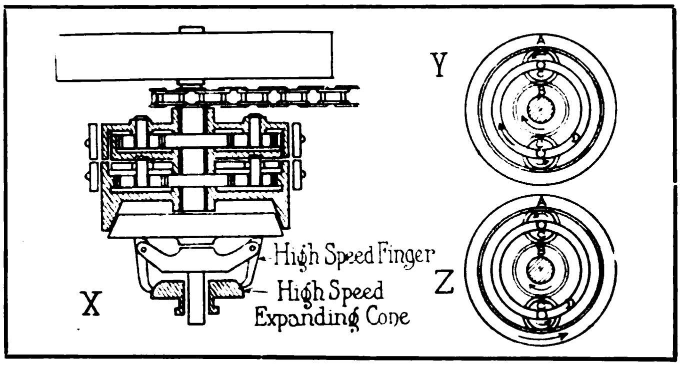
Your query implies that the only time the jerky action is experienced is when the intermediate gear is engaged. This is sufficient proof that the bearings are tight, for if they were not there would be a knock with any gear engaged. If you remove the grease from the transmission gearset case and examine the intermediate gear, you will probably find one or more teeth of the gear broken. It is imperative that you make immediate examination of the case, for the broken pieces may be carried between the teeth of other gears and cause further damage. If a new gear cannot be quickly obtained the machine may be operated if a selective drive by omitting the gear and always changing from low to high. If it is a progressive type gearset, you will have to exercise the uttermost care, as the remaining teeth of the gear can be easily broken.

Tight Bearings—B. L. F., Tarrytown, N. Y.
I recently overhauled my small truck and fitted several new bearings. I made the bearings myself, having a lathe and drill in the garage. The motor overheats very quickly. I would like to know if there is any danger of damage being done and if it is advisable to make the bearings larger.

It is evident that the bearings have been fitted too tightly. Of course there is always the possibility of doing damage to the motor by allowing it to become overheated. As you state that you have a lathe in the garage, I would suggest that you remove the body from the chassis and run a belt from the lathe around the flywheel and operate the engine in this manner for about a half day. When a large quantity of oil is used, usually the bearings will wear into a good seat. I would also advise the use of an excess amount of lubricant when the motor is operated on its own power for at least 200 miles.

Planetary Transmission—B. M. G., Columbus, O.
I have purchased a second-hand, two-cylinder truck and as the gearset is a planetary type, I would like you to describe its construction and operation.

Planetary types of transmission gearsets have two forward and one reverse speed ratios. The gearing is constantly in mesh, so the operator cannot strip the gears by careless shifting. The main member of the set is a spur gear, which is keyed to the drive shaft and meshes with small spur pinions carried on suitable spiders. These pinions in turn mesh with an internal gear drum. The action is extremely simple, but can be better understood by referring to the accompanying illustrations while following the description of the action. Should you desire the low speed a band is pressed which holds the internal gear drum A. As stated above, the spur gear B is attached to the drive shaft and must rotate in the direction indicated by the arrow. This drives the small pinions C, carried by the spider D, in the direction indicated. As the large internal gear is securely held by a braking device, it



The Principle of Operation of a Conventional Type of Planetary Gearset.

cannot rotate. This compels the pinions to travel around the inner periphery of the drum, which action causes the spider to rotate at a reduced rate of speed. Next consider the reverse speed. To simplify matters, consider that the driving sprocket is attached to the internal gear drum A. Hold the drum to which the small pinions are attached. The action is somewhat similar to the one described above. The spur gear B rotates with the engine. The spider to which the pinions are attached is held. This causes the pinions to rotate on their axes and to drive the internal gear A in a motion which is the reverse of the engine. The principle of operation never varies, although usually two sets of gears are used, one for low and the other for reverse. The high speed is a direct drive from the engine to the rear axle and is obtained by clamping all parts together so that they revolve in the same direction and at the same speed. This is accomplished by some type of clutch. A high speed cone, as shown on this page is forced between the spreading fingers, which in turn compel the clutch to grip. As the cone is keyed to the mainshaft it must revolve at like speed and thus the entire gearset is locked to the engine shaft.

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The Motor Truck

PAWTUCKET, R.I. OCT. 1915

VOL. VI. NO. 10.

WORKING THE FARM WITH MOTOR TRACTORS

SCIENTIFIC knowledge, system and efficiency have accomplished marvelous results in industry. The values of these factors, which can be applied very generally, have not been standardized, because other variables must be considered. No one will maintain that the limitations of industrial development have been reached. The possibilities of the application of these factors to agriculture are just beginning to be realized by those who have studied the subject.

Farming has been regarded as an occupation for those who were not fitted for industry or commerce. Its opportunities were believed to be extremely limited, but there is no question whatever that these are equal, if not greater, than any offered by any other form of endeavor. Without agriculture the world's population would not exist. Within a comparatively few years the national and the states' governments have co-operated in systematic investigation and research that has proven that there is equal need of organization, system, science and method in cultivating the land, and agricultural colleges and schools, experimental stations and bureaus are educating farmers as a class, and young men as specialists, who are revolutionizing farming.

Measuring the Depth of Furrow Made by a Gang Plow at the Farm Demonstration at Enid, Okla., This Year.

The purpose is to obtain greater productivity from farms. This may be either by intensified farming or by the cultivation of larger areas. In the sections of the country that are thickly populated, especially near the larger cities, intensified farming has been practised with results that are almost unbelievable. Property that is extremely valuable has been devoted to the growing of crops that are quickly marketed and are sold for high prices. Quality, successive plantings and control of volume are essential factors.

Factors of Intensive Farming.

In intensive farming climatic conditions are largely controlled by growing out-of-season crops in hot houses, where plants are either propagated or grown, by the use of irrigation systems, by special facilities for harvesting, sorting, grading, packing, handling and transporting; the scientific proportioning of fertilizers with the soils to adapt them to different products, the cultivation of what will in the least time restore the fertility of the ground, the rotation of crops with reference to tillable areas, and the use of the best and the most highly developed

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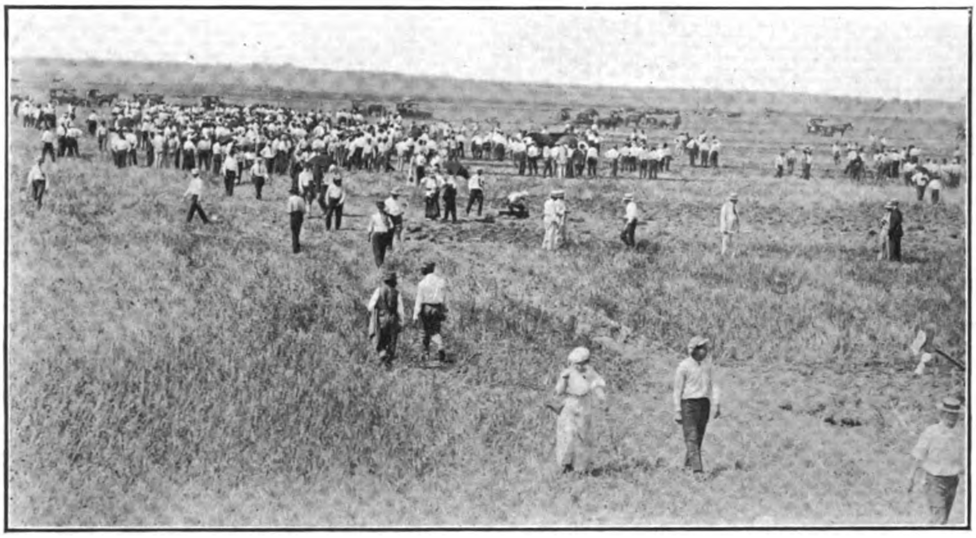


Spectators Following and Observing the Work Done with the Farm Tractors at the Southwest Tractor Show at Enid, Okla.

machinery, are adopted without question. These are the reasons why land worth thousands of dollars an acre can be used for agriculture with large profit.

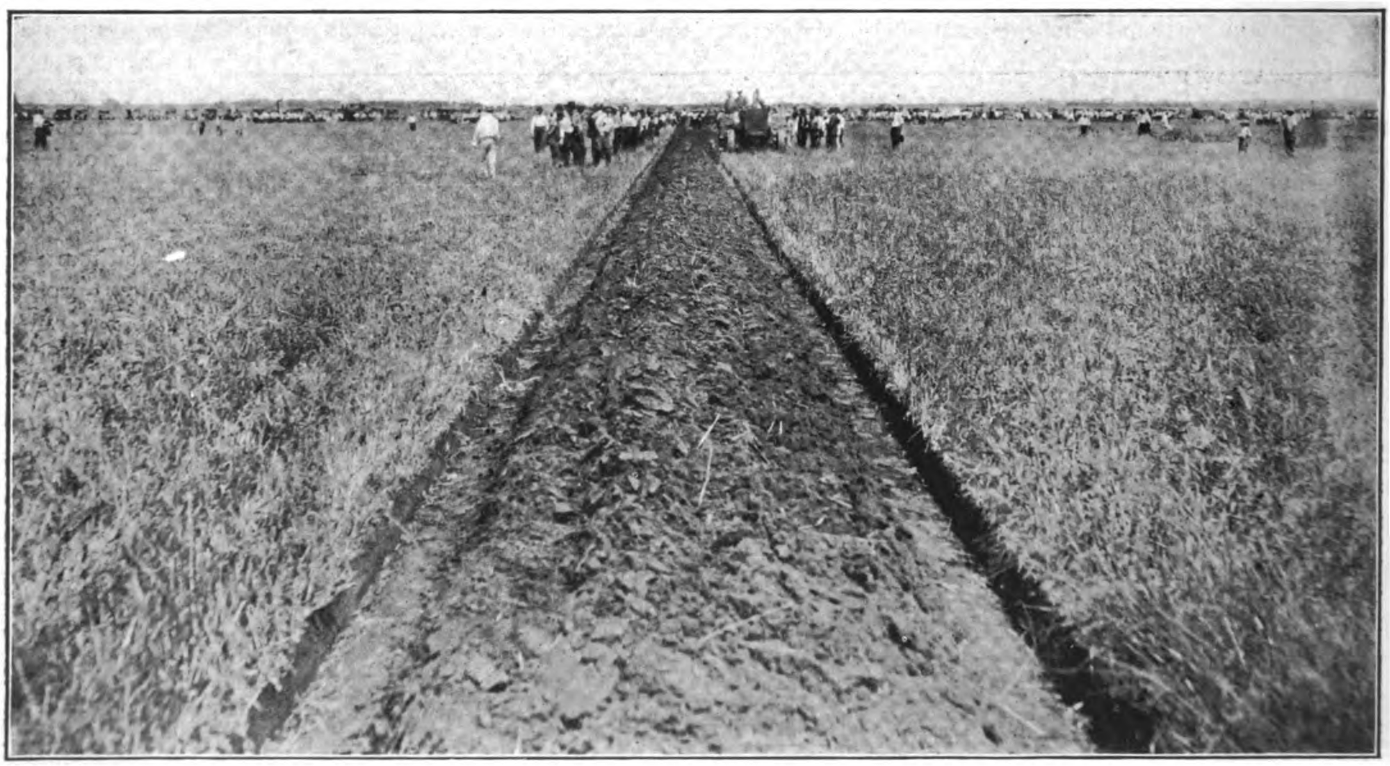
The crops grown are usually sold for immediate consumption. Highest quality and early delivery are vital essentials. Distance practically governs transportation expense. The land value restricts the area that can be used, and greatest production is necessary to insure profit. The more continuous the land can be worked the greater the yield. On such farms the work is as nearly continuous as is possible, and even out of doors cultivation or preparation is progressing during all the time the ground can be worked.

Specialization on Large Farms.

While concentration has been the rule with such farms as these, a different character of agriculture has been practised in sections more removed from the cities. The crops are generally one to the season, but the ground is as carefully worked, the period of preparation has been greatly extended and extreme care is taken to produce large yields. To the development of farms of this classification the endeavors of the agricultural specialists, organizations and institutions are directed. Because climatic conditions must govern the work to a larger degree than in intensive farming, extremely careful preparation and cultivation are absolutely necessary, and harvesting is generally at highest pressure. The facilities and methods must be equal to those required for intensified farming, though different in character.

The problem of labor is vitally important. The supply cannot be controlled and wages are increasing constantly. Farming machinery has been devised to save labor, this being generally of type to be operated with horses or mules. The utility of these machines has been established throughout the world. No one questions their value as compared with hand tools and they are purchased without hesitancy by the small farmers. The value of such tools is limited by the physical limitations of the animals.

Even those who assume to know may maintain that the small farms are to be found in the East and that



The Kind of a Furrow That Is Made by a Gang Plow Drawn by a Tractor, This Being an Incident of the Prairie Plowing Demonstration at Enid, Okla.

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One of the Demonstration Fields at Champaign, Ill., Where More Than 30,000 People Witnessed the Work of Tractors and Farm Machinery.

they increase in general proportions as one goes West, probably from the assumption that land is cheaper in price as one moves across the continent. But there are many thousand farms in the East that are rated as large because of the value of the crops, and, strange as this may appear, not a few of the eastern farmers are men attracted from the West to the East because of the better markets and the great reduction of the transportation expense in disposing of their crops. Many of them are cultivating eastern farms on what is regarded as large scale and combining with this dairying and other industries that are far more profitable than in the West.

The large farms of the East are devoted more to the staple crops, which are scientifically worked and specialized. The best of machinery is used and the operations are as a rule carefully systematized. There are, however, limitations to operating because of the cost of equipment. That is, every farmer who is a business man seeks to minimize his fixed charges. He cannot afford to maintain what he cannot use with a reasonable assurance of profit. Machine tools are cheaper than those operated with animals because there is operating expense only while they are used.

The power machines that obviate the use of horses intensely interest the farmer. The farm tractor of today is very efficient. It may be of any desired power and it may burn gasoline or kerosene as fuel. The first tractors were intended for large farming operations, but those now built are of comparatively small size, with capacity of doing work for which from two to 20 animals would be required. One of the greatest influences for tractor development was the automobile, and many of the principles of motor car or truck construction are embodied in them.

The first machines were expensive and few believed they could profitably invest in them. Not only this, but a handful of manufacturers, aside from those engaged in building other agricultural machinery, could afford the extremely expensive experimental work necessary to practically perfecting them. Besides this, the manufacturers were compelled to begin campaigns to educate the farming interests of the country to the utility of these machines.

Those who sold tractors did so on the basis of replacement of animals, this being parallel to the experience of those who first sold motor trucks, because they had no definite data and little or no knowledge of the operating economies and efficiencies that were practical or possible. Today tractors are sold largely, if not wholly on the practical knowledge of increased production of crops because of the better cultivation.

Better Cultivation Is Better Crops.

American farms produce the largest crops of the world in ratio to men engaged in farming, but on the basis of acreage the yield is far less than in Europe, where the land is highly valued and labor comparatively cheap, the American production being from 40 to 75 per cent. of the European averages.

The best authorities on agriculture maintain that quality of seed, the fertility of the land, the climatic conditions and the means of cultivation are the governing factors of crop production. By planting what the soil is best adapted to produce, a condition that can be accurately determined, and choice of seed, two of these are within reasonable control of the farmer. Climatic conditions can only be judged from experience and forecasted with prudence, but even with what may appear to be decided uncertainty, foresight

Plowing Prairie Land to Standard Depth with a Small Type Tractor at the Exhibition at Fremont, Neb.

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Another Example of the Work of the Tractor in Plowing Shown at the Exhibition at Fremont, Neb.

plowed or otherwise worked in the autumn after harvesting it is more easily prepared and is in much better condition in the spring. The period of planting is comparatively brief, and the harvest absolutely depends upon how well the ground is made ready. Cultivation to kill weeds and loosen the soil while the crops are growing and maturing is varied by conditions, but harvesting must be done quickly and skillfully to preserve the crops.

The facilities and equipment for doing the field work are the big problems for the farmer, especially when so much is dependent upon weather, for ground cannot be well worked unless reasonably dry. When preparation and planting and harvesting are to be done minutes are worth hours of any other time of the year. The farmer who operates on a large scale must have animals and machinery, or power and machinery, and seemingly the expense is large for the periods each are in use. In other words, the overhead charges of capital invested, interest, taxes, insurance, maintenance and repair are apparently much greater than for industry where there is more continuous utilization, and some of these items are as large as they would be in towns or cities.

is often an admirable insurance against crop losses.

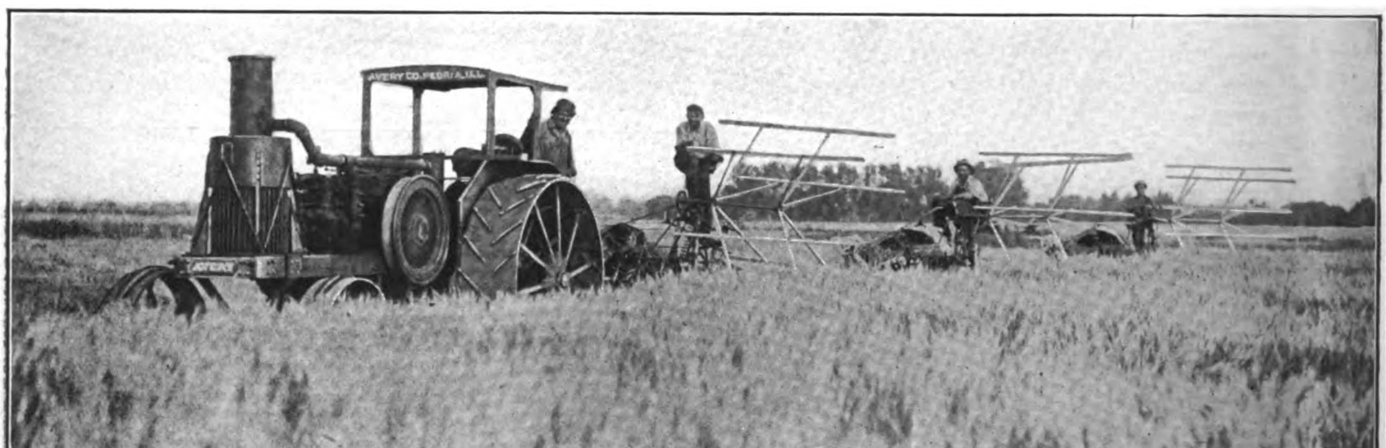
Some Practical Results.

With reference to better cultivating: From every angle results are dependent upon the preparation of the soil, and the more time that can be devoted to this the greater the yield. The universal spring plowing, once regarded as sufficient loosening of the earth, which was followed by harrowing, is now believed to be wholly inadequate, and more frequent turning and to greater depth has been proven necessary. This means plowing oftener, with different type plows or discs and work with varying tools to obtain thorough pulverization to provide suitable root beds, the necessary supply of plant food, the retention of sufficient water to insure full growth and to kill weeds, worms and insects.

The preparation that will obtain all this cannot be done in the limited time after the winter weather, for the ground must be sufficiently dry to work, and when

Efficiency a Determining Factor.

At this point in the consideration efficiency is the determining factor. In contrast with animals the tractor can be approved because with ordinary care its service may be extended over a generation at least.



Wheat Harvesting with Tractor-Drawn Machinery, Work That Can Be Done Very Rapidly and at Greatly Lessened Cost, Even on Farms of Moderate Size.

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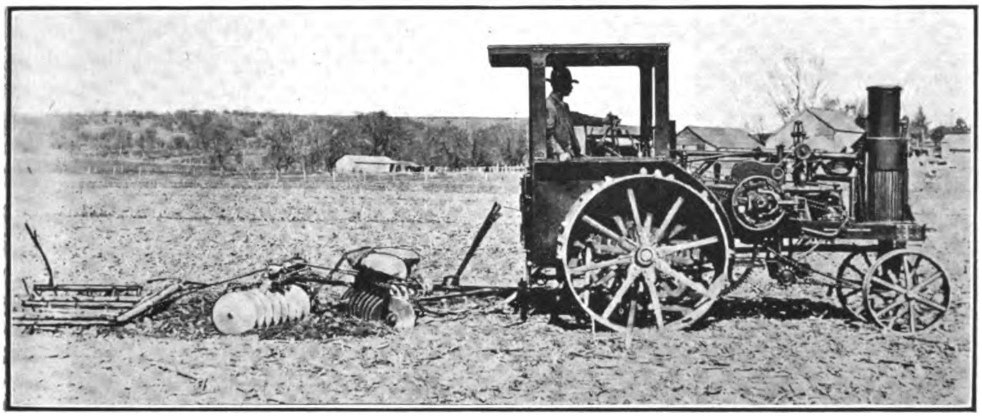


An Avery Tractor with Disc Plows and Harrows Attached for Working Fields That Have Been Under Cultivation.

ber of plows, with possibly the qualification of depth of plowing, could not be misunderstood and would be a definite statement of capacity. Incidentally this would obviate any difference in judgment of horse work.

Facts of Operating Expense.

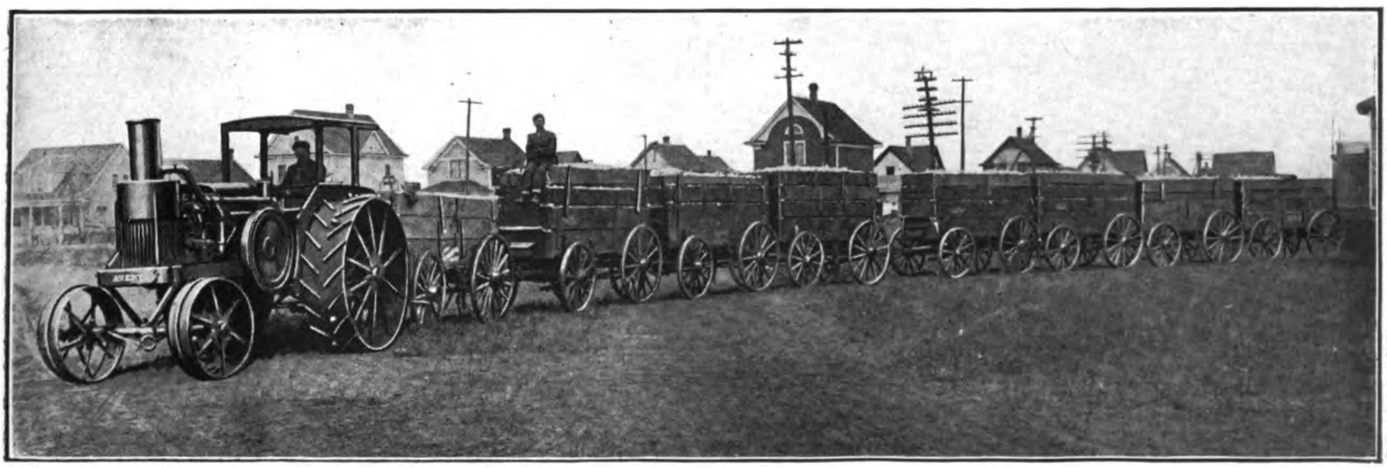
The operating expense of a tractor is dependent largely upon the consumption of fuel. Probably the best estimate is that given for internal combustion engines that are worked normally—a pint a horsepower an hour, and the lubricant can be estimated on a conservative basis as approximately equally 1/12 the quantity of fuel consumed. These figures will unquestionably vary according to the work, but they will be found fairly accurate. The labor cost is what the employer makes it, but from $1.50 to $2 a day is liberal. The number of working days of the year will vary decidedly, and probably 50 will be a reasonable average unless the owner could utilize them for other purposes, but as tractors can be used as power plants for any machine work, milk separating, grain separating, corn shelling, feed cutting, ensilage cutting, churning, wood sawing, shredding, thrashing, pumping, besides both heavy and light field cultivation, by belt attachment, the utility is obvious.

Animals could not be practically utilized for many of the purposes mentioned, and in contrast with these statement should be made that horses work an average of 100 days a year on farms, and their cost for food alone is approximately $80 a year, or 80 cents a working day. Governmental survey has established that the expense of caring for a horse is 170 hours' work annually, or an average of 17 working days of the year. This does not include the items of shoeing, veterinary attention, depreciation, interest, taxes, insurance, stable rent or other fixed charges. In other words, while the machine might be worked from 60 to 75 days a year, horses are seldom worked more than 100 days.

Unless operated there is operating or maintenance cost. It will do the work of a given number of animals, but it may be worked constantly, 24 hours a day and as many days as necessary with uniform results. With the use of lamps it may be used as well by night as by day. Fuel can always be obtained. Expert mechanics are not needed. Labor can be dispensed with. The expense depends upon the use made of the machine, but obviously there is an elasticity and a reserve that would not be possible without a very much larger number of animals and farming machinery than would be maintained on a basis, perhaps, of acres cultivated. Of course, the more a tractor is used the greater its value and the less is the cost based on the yield of crop to the acre.

The Power Rating of Trailers.

The statement is made by those who have given the subject careful attention that for general purposes a tractor can, without considering reserve capacity, be rated as equal to one horse for every two horsepower of its rating. That is, four horses equal an eight-horsepower machine, and so on, although the manufacturers of tractors are already seriously considering the advisability of rating the tractors by the number of plows of standard type that it can haul in a given condition of ground, this being a specification that can be the better understood by the buyers, and which can be demonstrated in practise. Conditions for plowing undoubtedly differ materially, but rating by num-



Avery Tractor Drawing a Train of Farm Wagons, a Manner of Highway Transportation That Is Intensely Practical and Economical as Compared with Horse Haulage.

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Bullock "Creeping" Tractor Pulling Two Sections of Disc Harrow and a Cut-Away Harrow Weighted with 400 Pounds of Stone.

The operating cost of the tractor ceases unless worked, while the horse cost continues uninterruptedly.

The Choice of Tractors.

The choice of a tractor depends entirely upon the conditions in which it is to be worked. Some work requires small machines and other large. There is just as much range for judgment as there is in determining what capacity truck to use for a given service. The size of the unit chosen ought to be based on the character of the land, the crops and the area to be cultivated, as well as the time that is available for cultivation, and the machine ought to have sufficient power so that it need not be overloaded. The purpose should be to do the work in the best way and in the least time, for time is extremely valuable when the work is necessary, and operating cost with the smaller machine is not sufficiently less to compensate for the additional time required.

No tractor should be purchased on the basis of replacing horses alone, but with the purpose of doing work that will produce larger and more valuable crops from the same area cultivated, or cultivating a greater area and producing equally good crops, for in any event the fixed charges of the farm will only decrease as its productiveness is increased. The general estimates of work possible with tractors are that with an allowance of four horses to a driver a 12-horsepower machine will do the work of two men, that a 20-25-horsepower tractor will do the work of three men, that a 40-horsepower tractor will do the work of five men, one man operating the machine. But what is of equal importance is that the work is uniformly and well done.

Bullock "Creeping" Tractor Hauling Two Sections of Disc Harrow, Cultivating 35 Acres a Day.

The Period of Service.

In determinations of animal service 10 years is rated as the average life of horses or mules, and for practical comparisons the same period may be assigned for tractors, but as a matter of fact of the 18 tractors that were built 13 years ago by one of the pioneer companies, and these were not the more highly perfected machines of today, 17 are in service and are so efficient that the owners, with long knowledge of the possibilities of power farming machinery, have not replaced them. This is a practical illustration of tractor life. Undoubtedly with good care a score of years would not be too long a period to depend upon.

For three years the farmers of the middle west have had the benefit of exhibitions and demonstrations of tractors in addition to those incident to the annual agricultural exhibitions. These were preceded by competitions held at Winnipeg, Canada, where for several years the manufacturers of the United States and the British provinces participated in trials that were organized under government officials, and projected for the purpose of directly benefiting the farming interests.

A Light Tractor and Gang of Plows, Designed for Work on Farms of Small Size.

This Year's Farm Machine Demonstrations.

The first one in the United States took place in 1913, but this year exhibitions were made at Hutchinson, Kan.; Enid, Okla.; Champaign, Ill.; Fremont, Neb.; Sioux Fall, S. D., and Bloomington, Ill. At these no prizes were offered, the manufacturers simply showing what was possible in conditions that could be observed by all, a number doing the same kind of work simultaneously. At Champaign, for instance, 31 tractor manufacturers and eight plow makers made exhibition. The Illinois State Agricultural college is located there, and in connection with the demonstration of farming tools there were series of lectures and demonstrations of farming methods directed by the college faculty and participated in by the students. The purpose was to make the occasion

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doubly attractive to all agriculturists, to interest as many as possible from a considerable distance, and to increase the scope and value of the extension courses of study projected by the college. The event was in no sense intended to promote the interests of the builders of tractors and other tools, but with the prestige of the state and the co-operation of differing organizations, including the farming press, to impress upon the farmers the possibilities with special machinery and the right methods to use at the right time.

Other demonstrations were not organized with the co-operation of state agricultural colleges, but there were numerous participating interests, and these events were specially attractive. They were attended by thousands of farmers who devoted valuable time and came long distances. The machines were shown at work and the possibilities made known far better than would be practical from any other form of display, and they were studied with extreme care, for the farmers are fast awakening to the profit to be obtained by producing larger and better crops from the same acreage.

Motor Vehicles Promote Tractor Sales.

A fact impressed upon the observer was that a very large number of farmers own automobiles, have a considerable knowledge of power vehicle mechanics, and understand the value of machines for farming purposes. One is amply justified in the statement that for a greater part of the work for which horses are now used machine tools will be found more economical, and that the agriculture of the future will be with not only on larger scale, but with methods and facilities that are as scientifically developed and applied as in the most advanced manufacturing.

The expansion of the automobile industry will be to a considerable degree responsible for this. The use of cars for pleasure impelled the development of highways, which were much desired by the farmers, but they decidedly objected to contributing to the taxes or in any way defraying the expense of building and maintaining these roads. A considerable period of farming prosperity and the very general use of cars by farmers changed the attitude toward road building, and the experience with automobiles is bringing about a knowledge of the economies of good highways and the possibilities of transportation with motor trucks.

With the uses of animals for haulage steadily decreasing because of the greater economy of machines, so far as the highways are concerned, there is every reason why the farmer will buy power machine tools that have quite as much to recommend them as have the automobile car or truck, and utilize horses or mules only where they may be, through some local condition, advantageous.

The Vacuum Oil Company, Rochester, N. Y., is to build an addition to its plant. It will be a filter building and will cost $17,000. This brings the company's expenditures for improvements up to $200,000 for the year. Next year it plans to spend $500,000 for factory expansion.

DISPLAY STAND FOR MASTER PLUGS.

The Hartford Machine Screw Company, Hartford, Conn., is offering to dealers handling Master spark plugs a display stand. The stand is 20 inches high, in three colors, with a brilliant red background. The plugs are in silver and blue. The stand is designed so that it can set on the counter, hung on the wall or used in connection with a window display. It calls attention to the fact that Master plugs have been adopted by the United States government and are used by the navy department, and also sets forth the selling points of Master plugs. Master spark plugs have been sold in much larger numbers in 1915 and an announcement of great interest to the trade is soon to be made relative to the sale of plugs in 1916.

NEW BOOK ON BEARINGS.

A new book entitled the "Use and Abuse of Ball and Roller Bearings," has been written by F. J. Jarosch, chief engineer of the Bearings Company of America. It is a 20-page pamphlet. Explanations and experiences are given in the tests which aid in the selection, mounting and lubrication of ball and roller bearings in automobile gears and in all other rotating parts. The information given is intended also to aid in detecting the real cause of bearing troubles. Nineteen drawings are used to illustrate the text. Automobile engineers or others interested can secure a copy of the booklet by application to the Joseph Dixon Crucible Company, Jersey City, N. J., who publish it.

HOLLAND ENTERS BUSINESS.

Walter E. Holland has resigned as research engineer of the Anderson Electric Car Company of Detroit, Mich., to become secretary and treasurer of the Broadway Automobile Company, Inc., of Seattle, Wash., which operates an exclusive electric garage business. The company handles Detroit electrics, Walker electric trucks, Ewell-Parker industrial trucks and Philadelphia batteries. Mr. Holland was for 10 years connected with the Edison Storage Battery Company in Orange, N. J.

The Bosch Magneto of New York announces that contracts for magnetos during the coming year have been made with it by the Federal Motor Truck Company, Detroit, Mich.; the Atlantic Refining Company, Philadelphia, Penn., and the Republic Motor Truck Company, Alma, Mich.

The McCord Manufacturing Company, Detroit, Mich., which makes McCord radiators, McKim gaskets and other automobile accessories, has purchased a plant at Wyandotte, Mich., where 125 men will be employed making gaskets.

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MOTOR 'BUSES IN HONOLULU.

Street Railroad Increases Facilities with Special Built Packard Machines.

The remarkable demands for transportation facilities that are evidenced in all sections of the United States are as manifest in the island dependencies of the nation as they are in the cities with which the people are familiar, as may be judged from the enterprise of the Rapid Transit Company of Honolulu, Hawaiian Islands, which recently placed in service a fleet of four machines, built by the Packard Motor Car Company and equipped with special bodies designed for service in the tropical climate.

Interior of the Specially Built Bodies Used by the Rapid Transit Company of Honolulu, Designed for a Tropical Climate.

Honolulu has a population of approximately 60,000 and it has a system of street railways that was constructed with a view of meeting the requirements of the city itself, but there are rapidly growing suburban sections which are increasing in importance, and which are not as yet sufficiently populated to justify the building of extensions of the different lines.

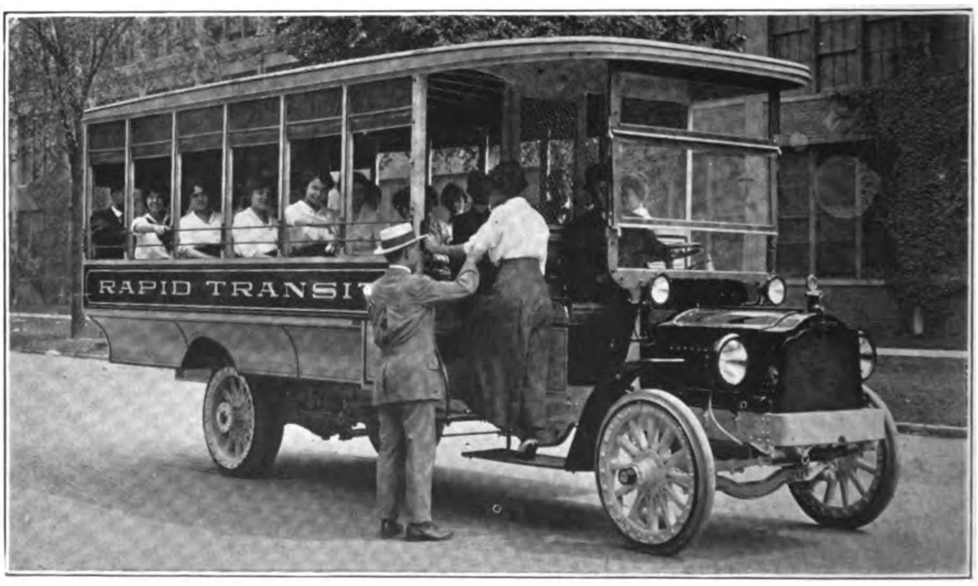
With a view of better serving these sections and of developing them to a point where permanent transportation equipment might be built, the street railroad company decided to establish a service with motor 'buses, which would be sufficiently elastic to be adapted to requirements and which could be operated economically. With this purpose in mind a plan was determined and four machines ordered from the von Hamm-Young Company, agent for the Packard company in the islands.

The chassis are the standard Packard two-ton truck type, which are standard in every respect, having worm and gear wheel power transmission systems, left side control and drive, and which have special electric starting and lighting systems, with Golden Glow headlamps and a special type of windshield. The additional equipment stated was desirable because of the use of the machines for passenger service and considerable night driving would be done.

The chassis are equipped with bodies designed and constructed by the Hopkins Manufacturing Company, Hanover, Penn., and New York City, a concern widely known for the excellence and diversity of the work turned out. These have inside seating capacity for 23 adult persons, and there is room on the driver's seat for an additional passenger. Because of the desire to operate the machines economically the driver constitutes the entire crew.

Entrance to the body is through a door at the forward corner of the right side, where the driver collects the fare. From his seat the interior of the machine and the passengers are always in sight, and the step is so located that he must observe the ingress and egress of all passengers, which is an insurance against accidents from starting too quickly.

The body has nine regular street car seats built of steel, brass and wicker work, and there is a special full width seat at the rear of the body that will seat five persons. The sides of the body are open, but they are equipped with heavy curtains that are operated on spring rollers and are sufficient protection against rain or heat, and there is always ample ventilation. There are three dome lights at regular intervals fitted in the ceilings of the bodies, which are ample for all requirements. The exterior finish of the machines are standard of all the cars operated by the company, a deep yellow with red trimmings and aluminum letter-



Type of Packard Two-Ton Chassis, Fitted with Special Body, Built for the Rapid Transit Company, Honolulu, Hawaiian Islands.

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ing, so they may be quickly identified in the streets.

The machines were shipped to the islands and are now in service, where they are giving excellent satisfaction. These vehicles are ordinarily operated on regular routes, but should occasion require they can be diverted to serve any section, additional trips can be made, and the hours adjusted by using extra drivers.

FIGHT RAILROAD CROSSING ACCIDENTS.

Because of the great increase in the number of grade crossing accidents in which automobiles have been struck by trains, the railroads are becoming seriously alarmed. These misfortunes have resulted in many damage suits and, furthermore, if they continue they will probably cause a nation wide demand for grade separations at every crossing, which would add enormously to railroad expense without increasing earning power.

The Long Island railroad, the Southern railroad, and now the Baltimore & Ohio have begun campaigns to educate the motorists. The latter road is making observations at various road crossings on its lines.

The number of cars passing the crossing in a day is taken and the number of each car is noted, along with the manner in which the driver crosses the tracks. The owners of the cars are then sent personal letters, calling attention to their need of greater caution in the future.

According to a report issued on a day's traffic over the company's tracks on Fayette street, in Uniontown, Penn., recently, 729 cars passed the crossing in 12 hours. Only 28 were stopped to see whether there was a train approaching and 24 were stopped because a train actually occupied the crossing. Of the 701 that did not stop 505 were not even driving slowly. In 52 instances the drivers looked in one direction, 135 looked in both directions and 542 did not look at all.

In the last year 29 automobiles have been struck by trains on this road. This is 16 more accidents than during the previous year, resulting in 23 more deaths.

A mid-western section of the Society of Automobile Engineers was launched at a dinner given recently at the Chicago Automobile club. The new section will embrace Chicago, Milwaukee, Moline and Hartford, Wis. A temporary organization has been formed and a permanent body, which will apply for membership in the parent association, will be organized soon.

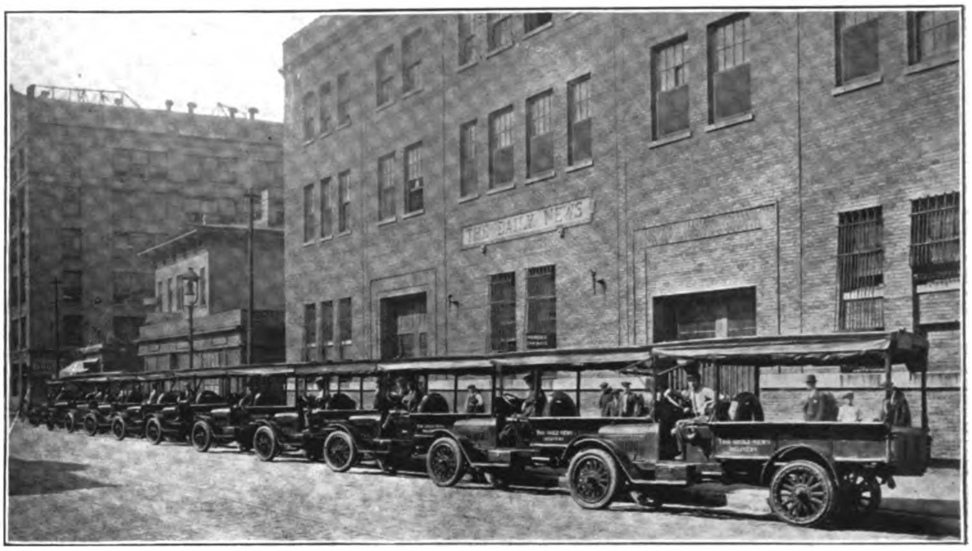
REPUBLIC NEWS CARRIERS.

Chicago Daily Newspaper's 400,000 Edition Delivered by Fleet of Trucks.

The Chicago Daily News, which has nearly 400,000 papers to deliver from its plant to stations about the city of Chicago and the railroad stations during a few hours in the afternoon, operates a large number of Republic trucks, which are equipped with Torbensen internal gear rear axles.

Twelve of these trucks—a part of the fleet—is shown in the accompanying illustration. It will be noted that the trucks are equipped with pneumatic front tires and solid rear. An extra rim carrying a pneumatic tire is placed behind the front seat of each truck, so that in case of tire trouble a minimum of delay will result from making replacement.

In newspaper service a few seconds in the time of



Part of a Fleet of Republic Trucks, Having Torbensen Internal Gear Drive Rear Axles, Used for the Distribution of the Chicago Daily News.

delivery is an important point for a circulation manager to consider, particularly when competition is severe and some extremely interesting event such as a world series ball game is chronicled in the paper.

The selection of internal gear drive for such service is assurance of its dependability and it is necessary, too, that the axle should be suited of use on a truck that must travel at much higher than average motor vehicle speed.

On the building just behind the second truck is a sign which reads "Horses For Sale"—something which should be worthy of note by many business men who have delayed until this time to replace their animal haulage by the more modern and efficient motor delivery.

Three new structures are building at the plant of the Republic Motor Truck Company, Alma, Mich., which will add 54,500 square feet of floor space to the factory.

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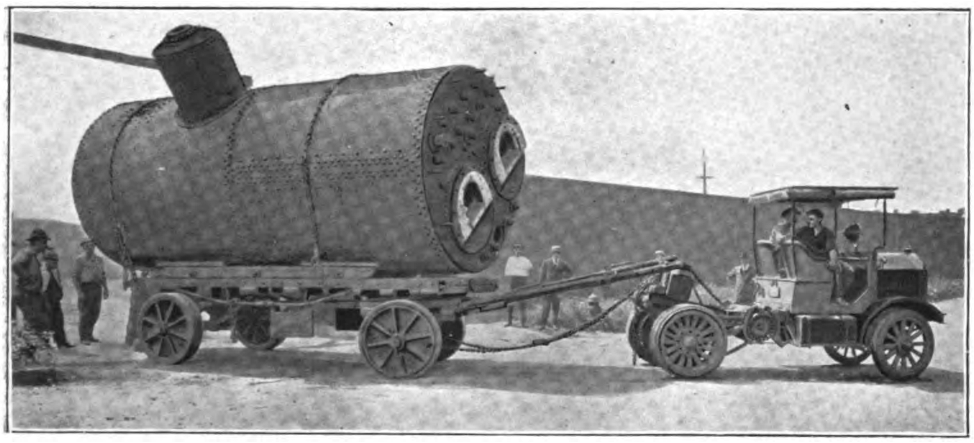
TRACTOR HAULED BIG BOILER.

Load of 41 Tons Moved in Philadelphia by New Type Knox Machine.

A contract was recently secured by the Henderson Contracting Company of Philadelphia, Penn., one of the largest firms in that city, to haul a 33-ton boiler from a power plant at Holmsburg, Penn., to the city power plant in Fairmount park, Philadelphia.

The heavy, low-wheeled wagon on which the boiler was carried itself weighed eight tons, so that the total load to be moved was in all 41 tons. An estimate convinced Mr. Henderson that 28 horses would be required to haul the load after it was in motion, and that 10 extra horses with block tackle would be needed to start it every time it came to a stop.

It is very difficult to handle so large a number of horses on an ordinary road and this difficulty is multiplied near a large city where much other traffic is to be encountered. Progress of the load over a long haul would be very slow with the horses and a great deal of time would be lost taking the horses home to their stables at night and bringing them out again in the morning.



A Knox Tractor Hauling a Boiler and Truck Weighing 41 Tons Through Philadelphia to New Power House at Fairmount Park.

About the time the contractor was prepared to start operations a representative of the Knox Motors Associates called upon him and assured him that although the tractor was rated at only five to 15 tons, it had ample power to haul the load for him.

Mr. Henderson was skeptical, but he decided to try. The attachment of the heavy tongue of the wagon carrying the boiler was about on the level with the deck of the tractor. The tongue was attached to the tractor by heavy chains and over blocking about 18 inches high, which was placed on the rear of the tractor frame.

The effect of this arrangement was to pull down on the rear of the tractor in proportion to its forward pull. The more power required to move the load, therefore, the greater would be traction applied to the rear wheels. The start was made without difficulty and without power from any other source except the tractor the load was hauled to its destination without incident in comparatively short time. Because of its bulk the tractor's load attracted much attention in the streets as it passed.

PROVIDENCE AUTO SHOW NOV. 12.

The annual Providence, R. I., auto show will open in the State Armory, in that city, Nov. 12, and will continue until Nov. 20. As in previous years, there will be a large department for the exhibition of motor trucks and power wagons, and because of the unusual demand for and interest in these machines, this will have a very large number of exhibitors and unusually complete displays.

OIL CONSUMPTION VERY LARGE.

For some time the consumption of crude oil has been considerably in excess of production. The reverse of this condition obtained a few months ago and large quantities of crude were stored in the oil fields.

The oil in storage has been rapidly reduced and there has been a general increase in the price of crude of about 10 cents a barrel. It may go higher. All eastern refineries are working to full capacity. The demand for gasoline is particularly heavy and some large orders are filled only after delay. Tank steamers have frequently been held for several days of late that gasoline could be produced to fill them.

Heavy shipments of crude from the Tampico and Tuxpam fields are now being made, indicating that political conditions in those sections are again favorable to business.

TRUCK REPLACES MULE TEAMS.

The celite taken from the Kieselguhr quarries at Lompoc, Cal., was formerly hauled to the drying yards by mule teams, and the finished product, Cilocel, was later transported in the same way. Motor trucks were thought impractical because the digging away of the mountain makes permanent road building impossible. A 2½-ton KisselKar truck was installed that has been used in every condition of loose road bed with much satisfaction. It moves more rapidly than mule teams and carries much larger loads.

Two new buildings for the Kissel Motor Car Company have been started at Hartford, Wis. They will provide space which will make it possible to double production in both passenger car and truck departments.

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SIGNAL WORM-DRIVEN 7000 POUND TRUCK.

EXTREME endurance has been the main purpose sought in the design of the 3½-ton heavy duty truck built by the Signal Motor Truck Company, Detroit, Mich., which, while conventional in every respect, has been simplified and made so simple that care and attention can be given with minimum labor, and repair and maintenance is exceptionally economical.

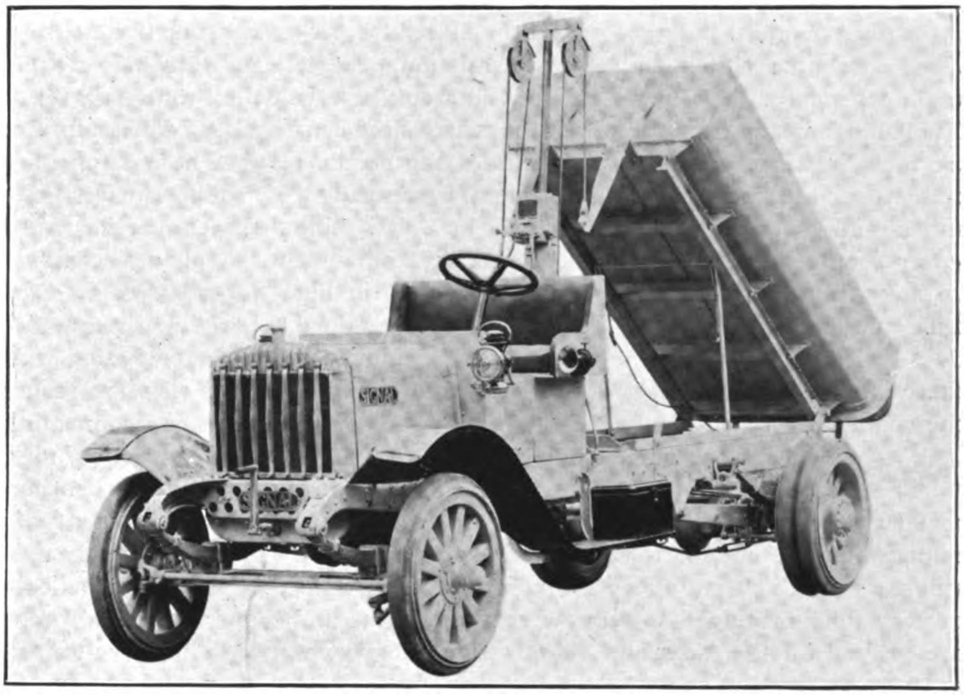
The Signal company, which has specialized smaller types of machines, which have afforded unusually efficient service, developed this type to meet a demand from owners who had, through the satisfaction obtaining from the use of Signal vehicles, a knowledge of Signal quality, and desired larger trucks of equal operating efficiency. Through the use of the highest grade materials and parts, by carefully proportioning and adaptation, a truck has been produced that weighs 6800 pounds, and yet is regarded as having greater endurance than vehicles much more heavily constructed.

The components entering into the trucks are selected as the products of specialists that have been proven by experience and service, so that there is nothing experimental or untried, while the production cost has been minimized through careful organization and extremely efficient factory facilities.

The designer, in building this truck, chose a special type Continental engine, a Brown-Lipe multiple disc clutch, a Brown-Lipe transmission gearset, Spicer shafts and universal driving shaft joints, Timken David-Brown type rear axle and Timken front axle, Detroit springs, Gemmer steering gear, Stromberg carburetor, Bosch ignition, and with these are a number of constructional features that insure greater efficiency. These components are standard products, carefully perfected and developed for the specific use made of them, and the principles of construction are so well known that no special tools or facilities are necessary and no mechanic need be specially trained to afford the care or attention essential to maintaining operating efficiency.

Special Type Continental Motor.

The Continental motor is a special type designed for truck duty, of heavy construction to endure severe operating conditions, that is highly efficient with low fuel and lubricant consumption. It is a four-cylinder, four-cycle, vertical, water cooled, L head type, with cylinder bore of 4½ inches and stroke of 5½ inches, that has a rating of 32.2 horsepower by the S. A. E. formula, which is claimed by the maker to produce 40 horsepower at moderate engine speeds, and to develop 55 horsepower at 1500 revolutions a minute. This motor is combined with a multiple disc clutch and a selective type sliding gear transmission gearset in a unit power plant for the trucks that are built for American use, but when the machines are to English orders and for use in England, the transmission gearset is with four forward speed ratios instead of three, and the gearbox is suspended at three points from two frame cross members with a longer clutch shaft and a shorter main shaft. The drive and control is right side. This change in construction is to meet the demands of those who are familiar with it and who do not favor the unit type so generally adopted in America.



Signal 3½-Ton Worm Driven Chassis Equipped with a Steel End Discharging Body and Hydraulic Hoist Elevated to Full Height.

Cylinder Units Cast in Pairs.

The cylinder units are cast in pairs from a fine grade of gray iron with the water jackets integral, there being large openings in the tops of the water jackets that are closed with cover plates retained by cap screws. The water jacket heads are cast separately. This construction insures perfectly unobstructed water passages and greater uniformity of the castings. The base flanges are unusually wide and heavy. The units are first tested by water pressure, then rough bored and aged, after which they are finish bored and ground to standard size. The machining is very carefully done. Then the unit is given a final water pressure test to insure against leakage.

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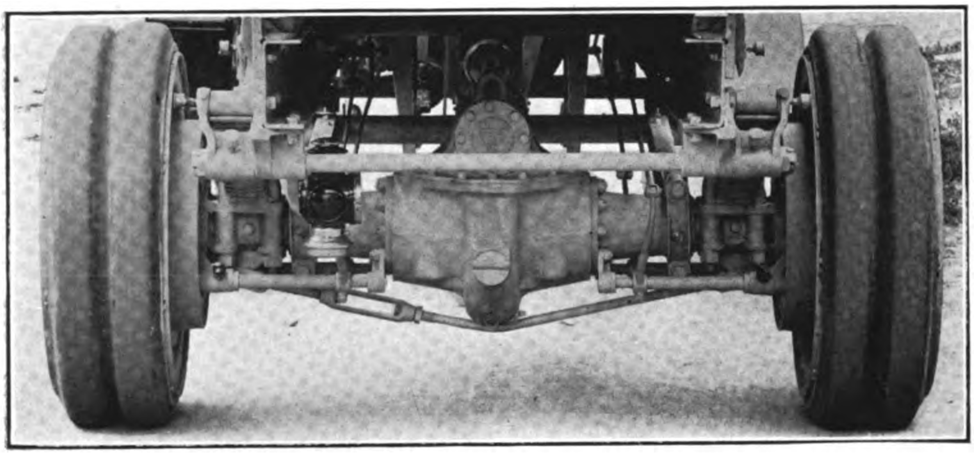


Rear End of Signal 3½-Ton Chassis, Showing the Timken Worm Driven David Brown Type Rear Axle and Spring Suspension.

are weighed and balanced.

The crankshaft is a special alloy steel drop forging that is 1⅞ inches diameter that is heat treated, which is carefully ground to size. The flywheel flange is integral, and flanges are formed at either side of the main bearings to take end thrust from the clutch shaft. The main bearings are three. 3 11/16 and four inches length respectively from front to rear, this giving a total bearing length of 10 11/16 inches. The camshaft is a steel drop forging with the cams integral that is turned, rough machined, heat treated and then ground. The camshaft is 2¼ inches diameter and it is mounted in three bearings that are 2½, 2¼ and 1¼ inches length respectively from front to rear. The construction is such that the camshaft can be quickly removed after taking off the timing gearset cover.

The crank case is of nickel aluminum alloy and is cast in two sections. Both have bell housing extensions at the rear to enclose the flywheel, and to which the clutch and gearset housings are bolted when the assembly is a unit, but these extensions are not provided when the clutch and the transmission gearset are independent. The upper half of the crank case is divided by a heavy transverse web that carries the centre main bearing. The forward ends of the sections are extended to house the timing gearset, there being a substantial cover plate that is retained by bolts. The lower section constitutes the oil reservoir, and in it are four transverse troughs or pits, into which the big ends of the connecting rods sweep. This is retained by a series of bolts and it may be quickly removed if there is occasion to inspect or work on the main and the connecting rod bearings.

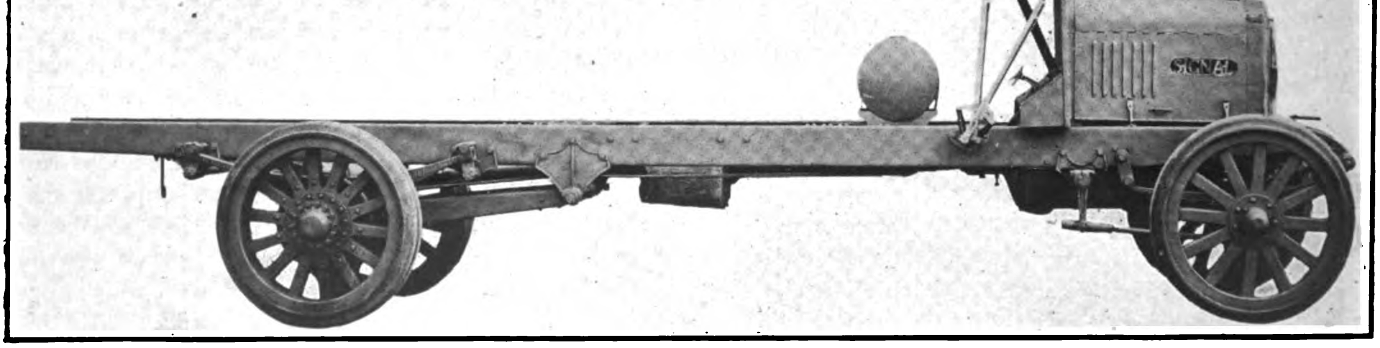
Pistons and Crankshaft.

The pistons are long and are cast of the same metal as the cylinders. They are turned to standard dimensions and cut for four eccentric split expansion rings, all of which are above the wristpin. The rings are carefully machined to remove casting strains and are ground on the faces and sides. Five oil grooves are turned in the pistons below the ring channels to insure thorough distribution of the lubricant and great care is taken to obtain perfect alignment of the holes for the wristpins. After completion all pistons

Wristpin, Connecting Rods and Valves.

The wristpins are steel tube that is carbonized and ground to size, that are clamped in the small ends of the connecting rods, and oscillate in the bearings in the piston bosses. The connecting rods are drop forged steel I sections that are heat treated, and are bored and reamed so as to obtain accurate alignment. The connecting rod caps are retained by nickel steel bolts that are securely locked. The crankshaft, camshaft and connecting rod big end bearings are a high-grade quality of nickel babbitt, the crankshaft and connecting rod bearings being retained by brass screws. The adjustment of the connecting rod bearings is made by the use of steel shims. The four timing gearset gears are helical cut and are practically noiseless in operation.

The valve tappets are a mushroom type, of special steel, and are mounted in large guides set in the base flanges. These are fitted with adjusting screws and nuts. The valves seat in ports 2¼ inches diameter and have nickel steel heads and carbon steel stems,



Signal 3½-Ton Worm Driven Chassis with Independent Four Forward Speed Ratio Gearset and Right Side Drive and Control, Built for Service in England.

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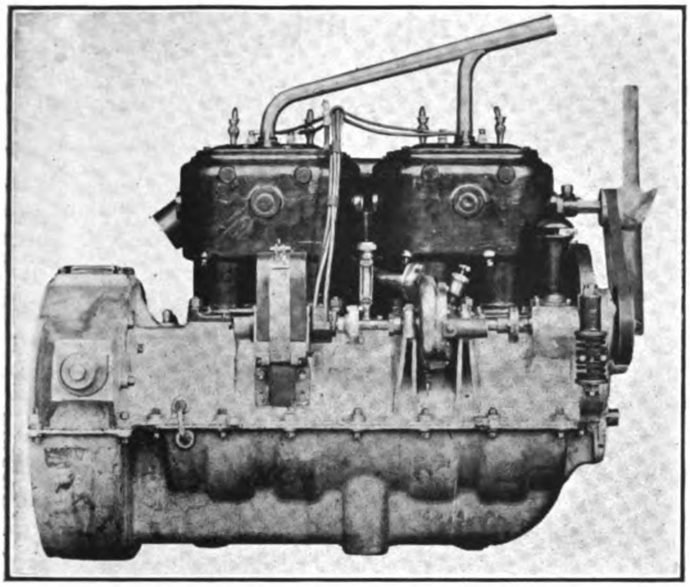


Right Side of Continental Special Truck Motor Used in the Unit Power Plants of Signal 3½-Ton Trucks.

electrically welded, and the stem ends are hardened. The valves operate in long bushings, and the stems and tappets are protected by removable cover plates.

The engine is cooled by water circulated through the jackets and a tubular radiator of large capacity by a gear driven centrifugal pump that has extra size bearings. The water inlet is at the base of the exhaust valves of each unit. A large fan is mounted on an adjustable ball bearing in a bracket on the forward cylinder that is driven by a flat belt from a pulley on the water pump shaft. The radiator is a built-up type with cast top and bottom tanks and cast water columns and a tubular central core, which is protected from damage by a series of vertical bars bolted to the top and bottom tanks.

The Lubricating System.

The lubrication is by a combination force feed and splash system, the oil being drawn from a reservoir by two plunger pumps actuated by eccentrics on the camshaft and forced through tube to the rear main bearing and the timing gearset. The excess lubricant drains to and maintains a constant level in troughs in the bottom of the crank case, where splash distribution by the sweep of the big ends of the connecting rods oils the cylinders, pistons, wristpins, cams, tappets and the centre main bearing. The camshaft bearings are lubricated from oil pockets cast in the walls of the crank case.

The carburetor is an automatic float feed type, designed for truck service that is fitted with a hot air duct to promote carburetion. The ignition current is supplied by a Bosch NU4 type magneto, which is used with a fixed spark. The power plant or motor is suspended at three points—on spherical bearings on the ends of the arms cast integral with the flywheel housing, and at the front by a trunnion in a steel bar that is mounted on helical springs. The motor is governed to a definite speed by a suction type governor that is adjustable and is secured by a padlock.

The clutch is a Brown-Lipe multiple disc dry plate construction, having 14 surfaces covered with asbestos fabric, the friction surfaces being eight inches outer and six inches inner diameter. All of the tempered saw steel clutch plates slide on hardened and ground keys riveted to the outer and inner clutch drums. The clutch thrust is taken by a bearing that absorbs both radial and thrust loads. The end of the clutch shaft is supported by annular ball bearings mounted in the flywheel that are packed with vaseline. The clutch pedal is adjustable to compensate wear of the disc surfaces.

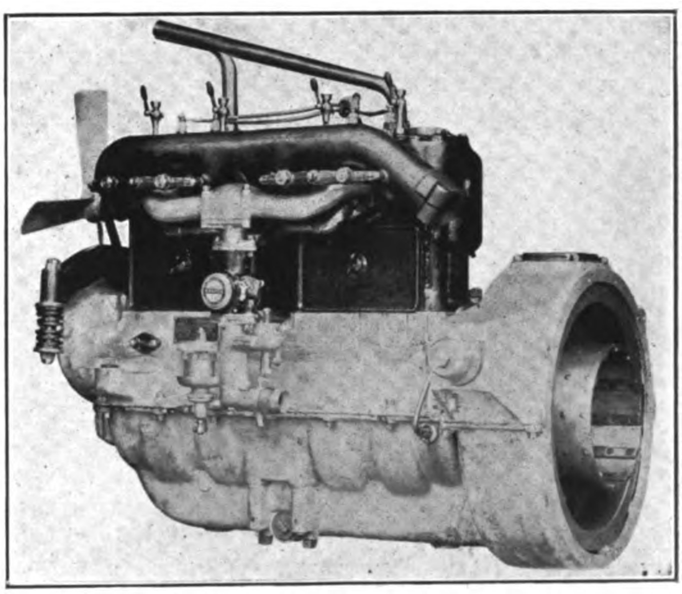
The transmission gearset is a Brown-Lipe selective sliding gear type, having three forward speed ratios and reverse. The gears and shafts are nickel steel, and the shafts are carried in Timken roller bearings. The control levers and pedals are mounted on the gearset case. The power is transmitted by a 2¼-inch tubular shaft in which are three heavy Spicer universal joints that are enclosed in metal cases. The rear end of the forward section of the shaft is mounted in a self-aligning ball bearing supported by a frame cross member.

Worm Drive Rear Axle.

The rear axle is a Timken worm and gear wheel David Brown construction, this being full floating, with a cast steel housing in three sections and strengthened with a truss. The worm shaft and gear wheel and the differential are mounted on the heavy cover plate of the central section, the assembly being a unit that can be taken out when the cover retaining bolts have been removed. The spindles are 3½ and three inches diameter. All the bearings are the Timken roller type. The front axle is a Timken design, I section, 3⅛ by 2¼ inches, with spindles 2⅛ and 1½ inches diameter, and fitted with Timken roller bearings in the steering pivots and on the axle spindles.

The Frame and Spring Suspension.

The frame is pressed steel, eight inches width, with webs 3½ inches width, the metal being ¼-inch thick-



Valve Side of Continental Special Truck Motor, Showing the Flywheel Fitted for the Use of a Multiple Disc Clutch.

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ness. This is strongly reinforced by three cross members and gusseted at top and bottom. It is suspended on semi-elliptic springs, a Detroit self-lubricating type that are guaranteed for two years against sagging, cracking or breaking. The front set is 45 inches length and three inches width, and the rear set 56 inches length and three inches width. All the spring eyes are phosphor bronze bushed and all the shackle bolts are fitted with oil cups. The rear springs are shackled at both ends to very heavy hangers. The relation of the rear axle and the frame is maintained by sturdy radius rods that rotate on annular seats on the axle housing, and are pivoted to very large hangers on the frame so that they may have a vertical movement with the axle. The radius rods, which are adjustable for length, take all the traction and braking stresses.

Other Chassis Details.

The wheelbase is 168 inches and the tread is 65 inches forward and 68 inches rear. The wheels are wood artillery type, having 12 2½-inch spokes in the front set and 14 three-inch spokes in the rear set, which are shod with 36 by five-inch solid band tires forward and 36 by five-inch dual rear tires. The tires are demountable. The steering column is at the left side, with centre gear changing and emergency brake levers. The fuel supply is controlled by a foot accelerator. The clutch and service brake are operated by separate pedals. The steering gear is a Gemmer worm and gear truck type, with ball thrust bearings and a 20-inch hand wheel. The brakes operate in 19-inch drums on the rear wheels, the shoes being internal expanding, 3½ inches width. Each brake has approximately 418 square inches braking surface.

The cylindrical welded steel gasoline tank is 30 gallons capacity and is under the driver's seat. The frame is built with 126 inches, 144 inches or 168 inches loading space length behind the seat, according to the buyer's specifications. The frame width is 38 inches. Normally the machines are governed to 15 miles an hour, but this can be varied to meet requirements. The standard equipment includes driver's seat, front fenders, steps, tool box, oil side and tail lamps, horn, jack and kit of tools. The price, in a priming coat, is $3000 f. o. b. Detroit.

KELLEY-SPRINGFIELD DIVIDENDS.

A quarterly dividend of three per cent. has been declared by the Kelley-Springfield Motor Truck Company, payable Nov. 15 to stockholders of record Oct. 15. This is 1½ per cent. greater than formerly, but it represents only one-half the company's earnings. The company has no debts and has a large stock of material, which will last well into next year.

The Prest-O-Lite Company, Indianapolis, Ind., has purchased the Brown-Smith Battery Company, Bloomington, Ill., which builds batteries for house lighting. No plans are announced.

TRUCKS WILL REPLACE TUBES.

Government to Abandon Pneumatic Service in Large City Postoffices.

There is much significance in the announcement that the contract of the postoffice department with the American Pneumatic Service Company for the use of the pneumatic tubes through which mail has been distributed to branch postoffices in large cities is not to be renewed, and that after this year the work will be done by motor trucks.

The American Pneumatic Service Company installed its first service in Boston in 1901. It laid tubes under the street through which carriers were forced by compressed air at high speed from the main to the substation postoffices. Each carrier was about eight inches in diameter, rolled on wheels, and carried about 20 pounds of mail.

After this system had been tried in Boston similar services were established in New York, Philadelphia, Cincinnati, St. Louis and Chicago. The government did not own the system, but it was put in by the company on a rental basis extending over 15 years.

Since the parcel post distribution was inaugurated packages of such size that they cannot be sent out in the carriers have been handled in large quantities. Considerable time also was required in the postoffice to load the carriers properly, and whenever a leak developed in the tubes much annoyance is often caused before they can be cleared and again be put in commission.

During the period since the system was inaugurated the motor truck has been developed and practically perfected. It has now been found that it is both cheaper and quicker to carry the mails by truck rather than by tube. Careful packing is unnecessary.

The decision to replace the tubes with trucks follows decisions dispensing with trolley service in many cities, so that it is evident in the view of postoffice experts that the motor truck is the most efficient means of mail distribution and its use in large numbers can be expected in all of the larger cities of the country. In many cases, too, the government is buying the trucks instead of depending on contractors to furnish the service.

Exhaustive tests are making at Oshkosh, Wis., of a gasoline-kerosene tractor built by A. J. and O. G. Patch, who were formerly designers for the Rumely and Fairbanks-Morse companies. One of the features of the machine is an electric light equipment that will make practical the work of the tractor at night, either for haulage or agricultural service.

The Weed Chain Tire Grip Company, Bridgeport, Conn., has established an assembling plant at York, Penn., where 60 men will be employed for a considerable length of time.

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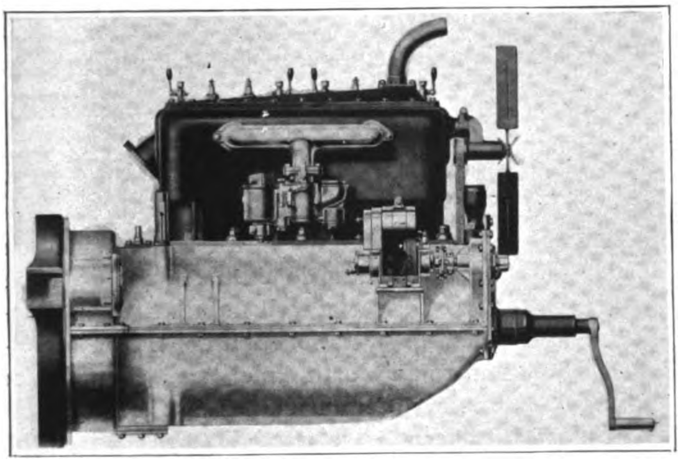
WISCONSIN TYPES TU AND UU HEAVY DUTY MOTORS.

DESIGNED especially for the heavy duty required in truck service, the Wisconsin Motor Manufacturing Company, Milwaukee, Wis., is now building two new sizes of motors that are designated as type TU and UU, these designations indicating the size.



Intake Side of the New Wisconsin Type TU Four-Cylinder Motor.

The engines differ in proportions only, the type TU having cylinder bore of four inches and the type UU cylinder bore of 4¼ inches, but the stroke of each is six inches. The type TU will produce 25.6 horsepower by the S. A. E. rating and the type UU 28.9 horsepower, but because of the long stroke, the bore to stroke ratio being 1:1.5, the power production is largely in excess of these figures. Conservatively estimated, 50 per cent. can be added to the S. A. E. rating.

Another important characteristic of these engines is that they are interchangeable in all dimensions, and they are so built that both sizes of cylinders can be fitted to the same crank case, this being a condition that will appeal to manufacturers who are using two sizes of power plants.

These engines are four-cylinder, four-cycle, water cooled, vertical, L head types, with the cylinders cast en bloc, the main purpose in designing being to produce what will have extreme accessibility and simplicity, and will endure in operation of more than usual severity. The construction is such that electric starting and lighting systems of standard design can be mounted on the engines without special work or additional fittings being required.

The Cylinder Block Design.

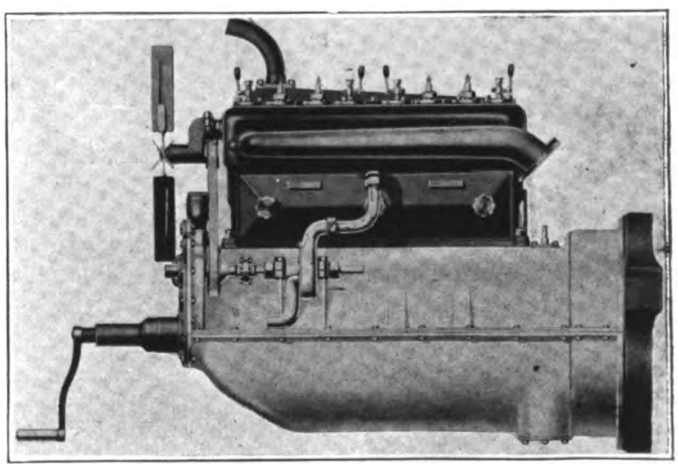
The cylinder block is cast of a fine quality of gray iron with the water jacket integral, and a part of the intake manifold is included in the casting, this being two straight tubes without pockets or bends, and these tubes are thoroughly jacketed. The water jacket head is a large plate with a centre channel to direct the flow of water with the outlet at the forward end, that is secured to the cylinder block by a series of cap screws. This construction insures thorough cleaning of the water passages and that there shall be no obstruction of the circulation. The water inlet is in the centre of the left side at the base of the jacket. The blocks are pickled and polished before being machined and after boring and reaming are aged to insure against all casting stresses. They are then ground and subjected to hydraulic tests to determine leakage.

The pistons are the same quality of metal as the cylinders and are carefully turned and ground to size, there being a slight taper from skirt to head. The wristpin bosses are webbed to give additional strength. Each piston is channelled for three eccentric compression rings of semi-steel and four oil grooves are turned in it. The rings are ground on the edges to accurately fit the piston channels. The wristpins, which oscillate in the piston bosses, are hollow tool steel, hardened and ground, and are clamped in the small ends of the connecting rods.

Four-Bearing Crankshaft.

The crankshaft is a four-bearing type, there being bearings at either end and between the second and third and the third and fourth cylinders, this insuring great rigidity. The shaft is chrome nickel steel and is two inches diameter, the flywheel flange being forged integral. The main bearings are very long, to obtain endurance and obviate springing, and the wristpin bearings are three inches length and the full shaft diameter. The main and connecting rod bearings are special babbitt mounted in bronze cages, this type having given extreme satisfaction in all Wisconsin engines. The connecting rods are I section, drop forged carbon steel and are adjustable with copper shims at the big ends.

The crank case is cast in two sections of aluminum alloy. The upper half has heavy transverse webs in which the main bearings are mounted, and is strongly reinforced with cross ribs. The lower half, which carries the oil reservoir, can be removed for examination of or work on the main and connecting rod bearings. The bearings are held by through bolts and the retain-



Exhaust Side of the New Wisconsin Type TU Four-Cylinder Motor.

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ing bolts for the cylinder block flange are fitted with collars. The timing gears are housed in a forward extension and are enclosed by an oil tight cover.

Three-Bearing Camshaft.

The camshaft is a steel drop forging with the cams integral, which is mounted on three large bearings. By removing the timing gearset cover the camshaft may be withdrawn. There are two outside shafts driven from this gearset, one of which can be used for driving a generator or timer at camshaft speed, and the other is utilized for driving the centrifugal pump of the cooling system. The former shaft is at the right side and the latter at the left side of the engine case.

The valve mechanism is conventional, the valve tappets being a mushroom type, carried in heavy guides, and are fitted with adjusting screws and nuts. The valve tappet guides are retained by crabs. The valves are tungsten steel, seating in ports 2¼ inches diameter, with large clearance. The valves are entirely water jacketed. The valve stems operate in long bushings. The valve springs are large and the valves and tappets are entirely enclosed by easily removable cover plates.

Pressure Lubricating System.

The lubrication is by the well known Wisconsin system. The oil is carried in a reservoir below the base of the crank case and is drawn through a filtering screen by a plunger gear-driven pump and forced through a main duct cast integral with the crank case to ducts drilled in the webs to the end main bearings. From the end main bearings it is forced through channels drilled in the cheek pieces of the crankshaft to the crank pins and to the two centre main bearings. There is an excess of oil at the main and connecting rod big end bearings and this is thrown by centrifugal force in the form of spray, sufficiently lubricating the wristpins, camshaft bearings, cams, cylinders, pistons and valve tappets, and through breather holes this spray reaches the valve chamber, affording ample lubrication for the stems and guides. There are breather holes in the cover plate of the valve chamber. There is constant pressure in the system and the pressure is increased with the speed of the engine. The oil pump is encased in the base of the engine, but it can be quickly removed, with the filter, from the outside. There is a ball and float oil gauge that indicates the supply of oil in the reservoir, and there are distinct high and low marks, between which the level of the lubricant should be maintained. A separate duct from the main system floods the timing gearset. All excess oil is drained to the reservoir and is circulated after filtration. The oil gauge is at the right rear end of the engine, and the oil filler is on the same side at the forward end.

Pump Circulates Cooling Water.

The engine is cooled by a forced circulation of water through the ample cylinder jackets, and radiation is promoted by a large fan that is mounted in a ball bearing in an adjustable bracket that is carried on the forward end of the cylinder block. The fan is driven by a flat belt from a pulley on the water pump shaft. The intake and exhaust manifolds are large and afford abundant supplies of fuel and thorough scavenging of the cylinders without back pressure. The carburetor is so located that it is very accessible.

The engine is to be mounted on three points, there being a trunnion on the steel cover of the timing gearset and a separate steel arm at the rear that is supported by the side frame members. A starting crank is furnished with this engine, which is carried in the extension of the front gear cover.

CANADIAN FIRE CHIEFS ORGANIZE.

At a recent meeting in Ottawa the Provincial Fire Chiefs' Association of Ontario decided to reorganize along national lines and changed its name to the Dominion Fire Chiefs' Association. In the future invitations will be sent to all North American makers of fire apparatus to exhibit their machines at the meetings. The following officers were elected: President, John Graham, Ottawa; secretary, James Armstrong, Kingston; chairman of exhibits committee, James Corbett, fire chief of the Massey Harris Company, Toronto. The 1916 convention will be held at Windsor, Ont.

CONTRACT FOR BOSCH IGNITION.

Eight concerns have made contract with the Bosch Magneto Company for the use of its ignition equipment in their machines the coming year. They are the Chandler Motor Company, Cleveland, O.; Brewster & Co., Long Island City, N. Y.; Stewart Motor Corporation, Buffalo, N. Y.; R. M. Owen & Co., New York City; W. Irving Twombly, New York City; Atterbury Motor Car Company, Buffalo, N. Y.; Blair Motor Truck Company, Newark, O., and the Brockway Motor Truck Company, Cortland, N. Y.

DETROIT S. A. E. OPENS OFFICES.

Permanent headquarters of the Detroit section of the Society of Automobile Engineers has been opened in the Kerr building, Detroit. This is the first of the local sections of the society to open quarters. The step has been necessitated by the recent growth of the society and the increasing importance of its work.

The White Company, Cleveland, O., after reducing its capitalization from $3,000,000 to $2,500,000 on Sept. 22, has filed a petition for permission to increase it to $8,000,000. This will be distributed among members of the White organization who desire to retire from active participation in the company, but wish to retain their investment. The interest of the public in the company is limited to $500,000.

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CONCENTRATION IN TRUCK SALESMANSHIP.

SINCE its inception the motor truck industry has been engaged in educating the people of America to first, the practicality of the machines, and, second, to the practical uses that may be made of them to realize the fullest measure of economy and service that are possible. During this period the manufacturers have had to meet and determine the best means of distribution, that they might establish satisfactory selling representation and meet the requirements of their customers.

The views of Martin L. Pulcher, vice president and general manager of the Federal Motor Truck Company, Detroit, Mich., relative to marketing methods and the probable results from the earnest co-operation of dealer and manufacturer, are those of a keen student of conditions and successful business man, and seemingly establish the fact that the future of the industry is unusually promising. Concerning this subject Mr. Pulcher says:

Martin L. Pulcher, Vice President and General Manager, Federal Motor Truck Company.

Through the past 10 years—more particularly the last five years—I have seen the motor truck industry lift itself out of a veritable "Slough of Despond," out of a mire of discouraging conditions, up on to a clean, solid footing, the stability of which might well be envied by many other industries.

It has been a hard battle, and a large number of manufacturers have dropped out almost as quickly and quietly as they started. For one of the most difficult and thoroughly discouraging features of the industry has been that of getting dealers—good live dealers who know where the business is and how to get it.

The average automobile dealer, providing he has a pretty fair line of pleasure cars, can make money more easily by pushing their sale than by pushing the sale of motor trucks—consequently, he neglects his motor truck account, usually, in favor of his pleasure car accounts. Most dealers in motor trucks alone, have in the past been only mildly successful. A few who have worked exceptionally hard along the right lines have been very successful with trucks alone.

We feel certain, however, that these conditions have been eliminated to a large extent. Years ago the dealer was up against a pretty hard proposition. The average motor truck was not what it should have been and all the profit the dealer made, and more, would be eaten up by free service, which the dealer had to give purchasers. The dealer has been educated away from the free service policy and the unscrupulous manufacturer has been forced, by competition, to either drop out in a hurry before damage is done, or bring his product up to standard at least.

While we use the very best of materials and parts in Federals, and while this is a strong feature in our sales, we find that it is not mere specifications which either the dealer or the prospect is interested in. It is the past record over a long period of time on which they make their opinions. It is essential that the dealer in choosing his line choose the best trucks, from a mechanical standpoint, in each respective field, from the light to the heavy types, from the following reasons:

Because the trucks have made a good record in all the important lines of business for a long period of time.

Because the initial price is right and cost of maintenance low.

Because the manufacturer of the truck is financially strong enough to insure its permanent place in the industry, and its organization is fair and square in all its dealings.

Because the manufacturer is a good, consistent advertiser.

Because the manufacturer has facilities to get actual operating costs and other information for all important lines of business, so that all dealers may have proper material with which to work upon prospects.

Because the manufacturer is equipped to give prompt service, and will live up to its guarantee in spirit as well as in letter.

Because the manufacturer is equipped to co-operate in sales and advertising with dealers whenever necessary or seemingly desirable.

The dealer should, we believe, concentrate upon one small territory, rather than try to handle too large an area. Such concentration brings more in the end than more widely scattered efforts will, for, in a comparatively small territory the dealer can tell from actual observation of the requirements of the various businesses, whether one-ton or five-ton trucks would be more efficient—in other words, he can get a better focus on the demand and how to best supply it. Bad mistakes have been made in the past through dealers not studying their territory's requirements, and because handling the wrong capacities and having to sell them, they "force" the purchaser, who is then disappointed to find results are not what were to be expected. The wrong size trucks can't get the right kind of results.

Through concentration on a small territory the securing of new, live prospects, and the following up of those prospects, is made easier and much more effective.

One of the best ways I know of to secure the immediate, and, in a large percentage of cases, the permanent interest of prospects, is to write them personal letters after close observation of their transportation equipment. Whenever horses are seen laboring under hard conditions, fatigued by heat, stuck in the snow, fallen on slippery roads, that is the time to show user of those horses, inefficiency, wanton waste and cruelty of such haulage methods. Backing up leads of that sort with literature produced especially for the line of work the prospect is in, and with exact figures showing costs of operating with trucks vs. horses, will start the prospect nine times out of 10 in the direction you want him. There is no end to the interesting savings and advantages that should be brought to the attention of the prospect—information that should be handled diplomatically, however, and followed up regularly until the time for demonstrating the trucks themselves—after which should come the sale.

At proper intervals between personal letters, direct mail advertising, etc., should come personal interviews by the salesman, and the salesman who has facts and figures to show, can usually get a very interested interview with the men who buy trucks.

Telling the man what trucks are doing in his line of business, then applying that information to show what they could do for him, and telling him what he can save over his present equipment are the essentials—above all else—in following up prospects, whether it be through advertising literature or personal contact. The mechanical features of the truck enter into the final stages of the selling, and should not, in my opinion, be sprung too early on the prospect.

Every concern with a good rating in Dun's and Bradstreet's, and which requires transportation equipment of any kind, can use some kind of motor trucks to better advantage than any other equipment now known. Those concerns are the prospects. Get them by advertising—good advertising, that is made as close to the prospect's business as possible.

There will be, conservatively estimating, more than a billion and a quarter of dollars spent for commercial cars in the next 10 years by American business men alone, such is the magnitude of this industry after a comparatively few years of development.

SOME GOODYEAR TIRE FIGURES.

During the coming year the Goodyear Tire and Rubber Company will produce 2,000,000 tires, each of which at a conservative estimate will be good for 5000 miles travel. About 40 per cent. of this output will be used on new cars and the remainder will be sold direct to owners to replace worn out tires. The total mileage necessary to wear out the year's output is 10,000,000,000 miles. A car with four tires would have to travel 2,500,000,000 miles to wear them all out. This would be equal to travelling around the world 100,000 times or going to the sun and back 14 times. At a speed of 40 miles an hour, 24 hours a day, a car would have to be driven 6000 years to make the distance.

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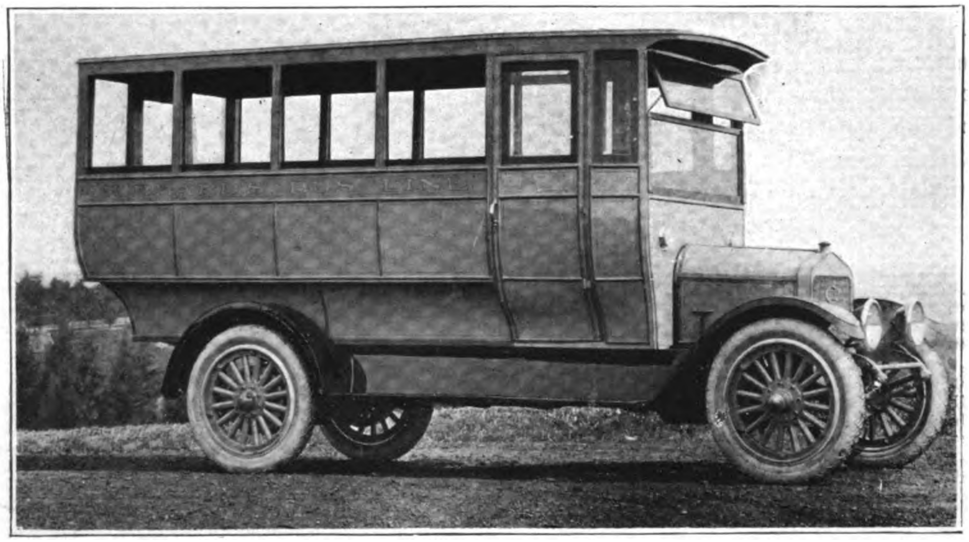
LIGHTWEIGHT MOTOR 'BUSES.

Special Equipment on 1500-Pound Chase Chassis for Fast Passenger Service.

The majority of motor vehicles designed for passenger service are heavy because of the very general desire for large capacity, and the speed is naturally limited so that the drivers will not drive fast. The desire is to minimize tire expense, and this means that solid shoes are generally used, and for this reason speed in excess of 15 miles an hour is advised against.

A machine that is an exception to these very broadly accepted limitations has been built by the Chase Motor Truck Company, Syracuse, N. Y., to meet the requirements of the Hubbard 'Bus Line Company, Massena, N. Y., and this was followed by an order for four others of the same type. The service for which these vehicles are used is between Massena and Syracuse, the round trip being 25 miles, and there was a desire to have trips with comparatively short intervals between rather than operate heavier units of greater capacity less frequently.



One of a Fleet of Five Special Omnibus Bodies on 1500-Pound Chase Chassis, Built for the Hubbard 'Bus Line, Massena, N. Y.

In determining the equipment the company sought what would have substantial comfort for the passengers and thorough protection from heat or cold, and what could be operated with minimum economy. This necessitated a fully enclosed type of body and pneumatic tires, and, of course, the lightest chassis that could be depended upon to carry the normal freight. The company selected the 1500-pound Chase chassis as best meeting its requirements for a machine, and the body equipment is spacious, is finished inside in the natural wood, and the exterior is finished a battleship gray, with lighter gray striped molding.

The chassis are equipped with electric lighting and starting systems, the interiors being lighted by dome lamps. The side windows may be lowered if desired, and the windshield is ventilating, but the window of the door is not movable. The entrance to the body is at the right side within full view of the driver, the intention being to make stops only at the right curb according to the direction of travel.

The Chase company is completing an order for 20 machines of the same general character, which will be mounted on the model R two-ton chassis, and which will have larger passenger capacity. These vehicles are to be delivered to a western transportation company, which has been organized to inaugurate a passenger service of large proportions.

STREET VEHICLES IN PARADE.

A street cleaning parade was held recently in New York City, which was reviewed by Commissioner Fetherston and his staff. A feature of the parade was the 12 10-ton gas-electric tractors which the department is using to keep clean the model district in Manhattan, between 14th and 42nd streets, and between Sixth avenue and the Hudson river. Each tractor is supplied with semi-trailers, a brush, a scoop, a sand spreader, several covered carts and a snow plow.

The parade was for the purpose of demonstrating progress in the construction of street cleaning apparatus and more than 100 pieces were sent from other cities for display. Five hundred "white wings" also marched. The suffragists brought out five automobiles with banners and drove along behind the column. The street cleaning and police bands furnished the music.

At a meeting held in New York during the exposition 200 heads of street cleaning departments in American and Canadian cities formed a street cleaning league of the United States and Canada. Annual parades and exhibitions will be held for the interchange of the newest ideas in municipal sanitation.

Rubber shipments from the Amazon valley to Europe for July, the first month for the new crop, were less than one-half what they were in July, 1914, but the shipments to the United States showed a 30 per cent. increase. The total shipments last year were 4,634,018 pounds, as compared with 4,252,802 pounds this year. In July, 1914, 2,252,204 pounds were shipped to the United States, while in July of this year the shipments totalled 3,446,949.

The Knox Motors Company of Springfield, Mass., adopted an eight-hour day for its men beginning Oct. 4.

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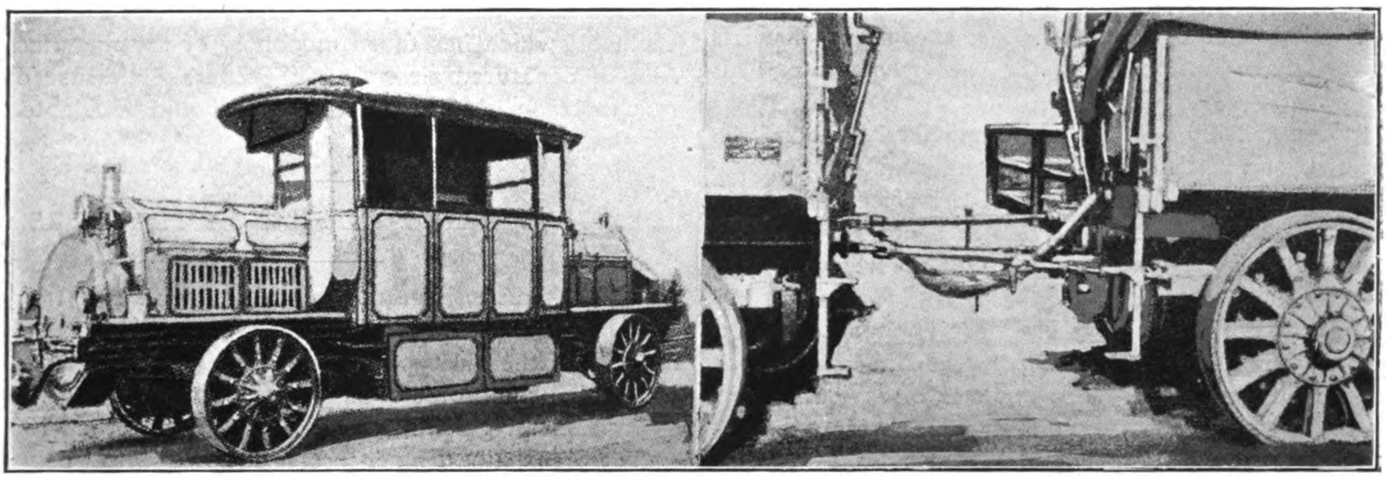
NO ENGLISH WAR TARIFF ON MOTOR TRUCKS.

German Gasoline-Electric Road Trains—Economy of New Zealand Postal Service Machine—Heavy Duty Steam Wagons in England—Special Delivery Bodies.

NOW that Chancellor McKenna of the English Exchequer has proposed a budget containing a 33 1/3 per cent. duty on passenger automobiles, but exempting commercial vehicles, there is much speculation as to the probable result of the suggested new taxes. France is said to be considering raising its import duties on American machines to 45 per cent., which is the ratio of the import tariff assessed on French motor vehicles by America.

The increase in the number of American cars imported into England during the past year has not been due to the efforts of American manufacturers, but to the demand by the English automobile dealers. When the production of cars ceased as the factories were converted to the exclusive building of war transports and manufacture of munitions, English dealers and garage owners found themselves lacking machines, with no prospect of obtaining them in their own country.



Gasoline Ele ctric Tractor for German Road Train Shown at Left—At Right, Design of Coupling Units for Hauling or Backing.

If they carried on their businesses through the war without selling cars financial ruin was inevitable. For self preservation they sought cars and turned to America as the logical source from which to obtain them.

But American manufacturers had more orders from American dealers than they could supply and could not sell cars to England without depriving their own established agents. The result was that the Englishmen got only a few cars and at that they were forced to accept them at higher wholesale prices and with less assurance of prompt delivery than was given to American dealers.

Failing in many instances to find established American makers who would supply them, some made contracts with new or almost unknown American companies and took these cars to England in large numbers.

So the situation is that with the exception of three or four large companies with soundly established English branches, the American manufacturers will be unable to really make an invasion of the English market so long as American prosperity continues.

The proposed English tariff is not a reversal of that country's well known free trade policy, but is a war measure adopted to cut down the sale of imported cars in England as a measure for equalizing the exchange rate and aid in securing the same effect that was sought by the $500,000,000 loan in this country.

When the war is over such a tax, if imposed, would probably be removed. By that time American makers may be ready for a real export campaign. Meantime, the tariff will possibly reduce the number of American passenger cars sold in Europe, but as the English makers are unable to produce cars in quantity, or much increase their prices, it is still probable that a large part of the cars sold in England in the immediate future will be of American manufacture. The tariff does not affect the growing market for American trucks at all.

Incidentally, it is noticeable that as the war continues the English and French governments have not decreased, but have rather increased their orders for American trucks. Their own plants are still building some trucks, but they are being used more and more for the production of munitions.

This continued purchasing of trucks must indicate the beliefs of the war offices that American trucks are as good as European machines sold for the same prices or better, and that the wise policy is to buy trucks and make munitions. If this theory is true it is quite likely that large exports of motor trucks from America will continue throughout the war.

The Ford car will practically escape the effect of

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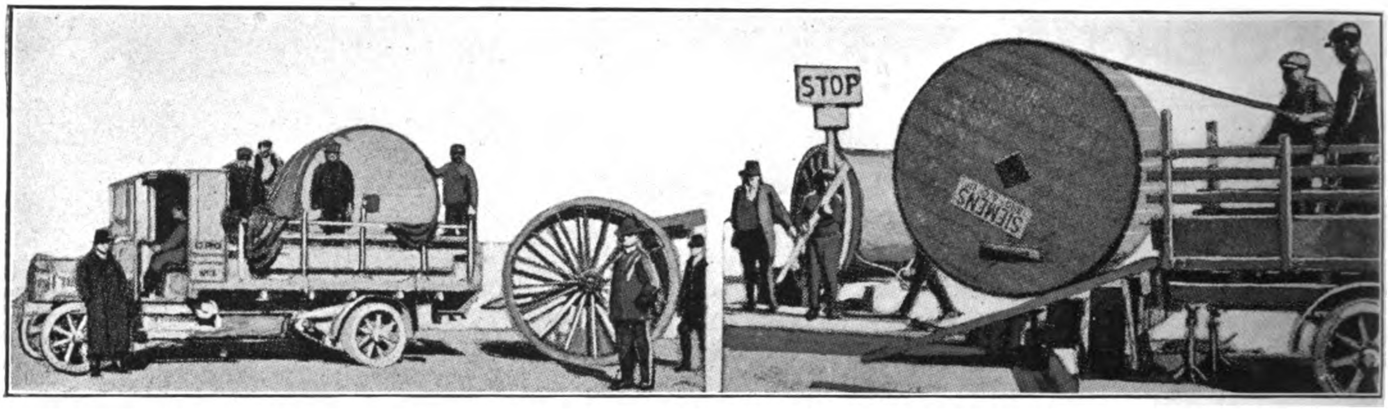


New Zealand's Postal Department Truck in Service—At Left, the Machine Loaded with a Reel of Cable; at Right, Loading a Cable Reel with a Power Winch.

the tariff. Only the motor and the more vital parts are imported from America, these representing about one-third of the value of the car. The rest is made in England and will not be dutiable.

FARM TRACTORS IN FRANCE.

So alarming is the scarcity of horses and agricultural labor in France that the French parliament has granted subsidies to farmers, groups of farmers and municipalities which purchase motor tractors or motor plows. The subsidy will amount to a maximum of one-third the purchase price, except in districts which have suffered from the war, where it may be one-half.

The subsidy will be paid immediately it has been shown that a tractor has been purchased and that the purchaser has paid his share of the price. The plan has already become effective. Inspectors will watch the work of the machines and will report every year the results secured.

Just after the subsidy had been announced a demonstration of American, French and Italian machines was held near Paris. The minister of agriculture attended. The American made machines were two Bull tractors, an Aultman-Taylor, a Case tractor and a Bijou. The smaller units attracted the greater attention. American manufacturers who will exploit this market must build small machines that can be turned quickly for use in the limited French fields.

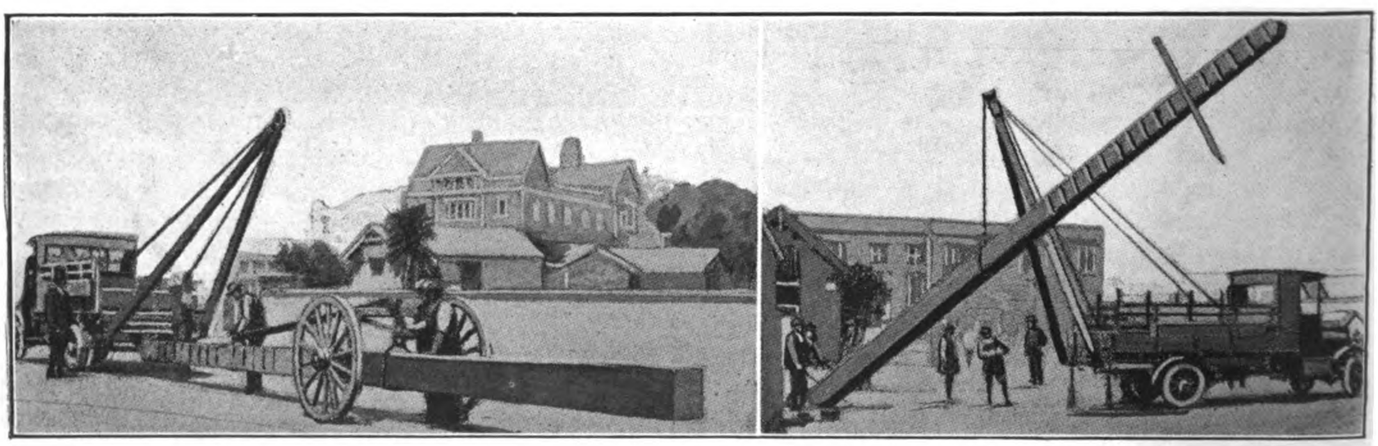
England has held several tractor demonstrations lately. In July at a fair at Vejle, Denmark, a demonstration was given of three motor plows, one manufactured in Sweden, one in Denmark and one by the International Harvester Company of America. These were of the small type suitable for the average European farm.

No computation of the cost of plowing by tractor was made, but it was clearly evident that it was cheaper than with horses.

In France gasoline is very expensive and the government, which has taken monopoly of the manufacture of denatured alcohol, will encourage the use of that fuel, so carburetors and engine should be adapted for that fluid.

GERMAN TRAINS VS. FRENCH TRACTORS.

The Germans have not taken up four-wheel tractors, but use instead road trains drawn by very heavy tractors of the old type. The Austrians depend upon similar haulage, some of the tractors used hauling the 305 millimeter guns, having engines of more than 100 horsepower. The French prefer the four-wheel drive type because greater tractive efficiency can be secured with lighter weight, the machines do not break down the roads so quickly, and bridges can be used that



At Left, the Truck Equipped with a Trailer for Drawing Heavy Timber and Poles; at Right, Raising a Pole with the Truck's Crane and Hoisting Apparatus.

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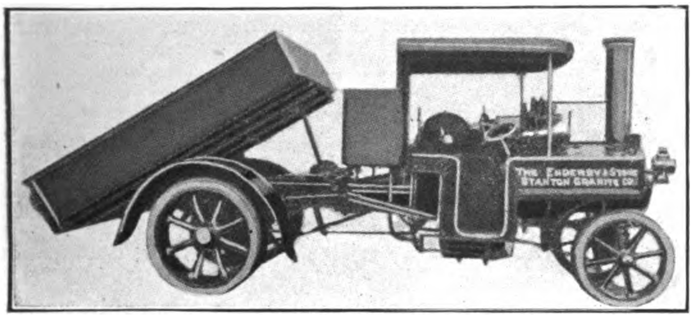
would not stand the great weight of the German tractors.

Some German road trains are made up of vehicles



Mann Five-Ton Steam Truck Designed for Side Stoking by the Driver While in Motion.

that have driving equipment. The tractor carries a dynamo and there are motors attached to or in the wheels of each of the freight carrying machines. There is in each train a tractor and six freight cars, with a total capacity of 30 tons. Such a train can travel at an average speed of from six to seven miles an hour. The wheels are a little less than 36 inches diameter and are shod with eight-inch tires.

All parts are interchangeable, so that the supply of spares necessary is reduced to a minimum. The vehicles can be run in either direction with equal speed. The tractor is a double-ended construction, carrying at either end of the chassis frame an 80-horsepower engine. In the centres are the dynamos and their regulators and the drivers' cabs.

Regulators and commutators are not on the drawn vehicles because of the system of coupling and a very large variation in tractive speed is permitted. The fields of the electric motors are connected in series and the armatures in parallel and draw their supply of current from the main dynamo.

Draw bars between the trailers are arranged to connect with the steering wheels so that each vehicle follows exactly in the track of that ahead of it. When there is need to reverse the train the steering gear is disconnected. The last trailer is fitted with a long shaft or pole for steering, and while the train is running backward it is guided by hand by this shaft.

The position of the tractor in the train is a matter of indifference. For demonstration purposes it is sometimes placed in the centre of the train. In practise, when it is on the road, the tractor is placed at the head of the train. The trailer units can be moved individually and for this purpose a long cable is supplied with which it is possible to move any one of the trailers about 300 yards without moving the tractor.

NEW ZEALAND USES TELEGRAPH TRUCK.

A truck for use in stringing and maintaining telegraph lines which is based on American practise has been adopted by the Post and Telegraph Department of the Dominion of New Zealand.

The first truck was placed in service in 1913 and its operation has been so successful that three other similar units are to be added. The chassis is that of a standard four-ton truck and has mounted on it an ordinary type of side drum winding gear, which is driven by bevel gears off the main driving shaft. The side drums are outside the frame members and extend about six inches beyond them. With these a pull of about two tons can be obtained.

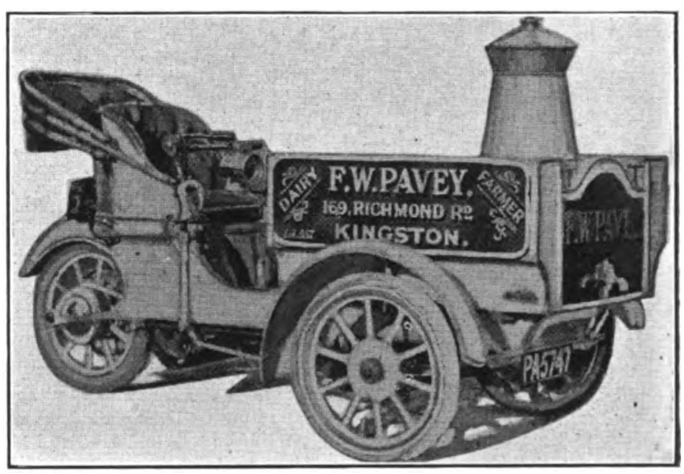
The main central lifting drum has been tested up to a weight of three tons. The standard lifting speeds, of which there are two, give hauling rates of 20 feet and 40 feet a minute. By the use of special gearing a maximum of 150 feet a minute is practical.

The various uses of the truck include: The transportation of men and materials to the field of operations. It lifts out condemned poles and drops new ones into the holes. It lays underground cables in their beds and draws overhead wires over the cross arms of poles.

A special two-wheel trailer, designed to carry a reel of cable, is used in connection with the truck, so that two reels and a crew of men can be taken to any place where work is to be done. This formerly required three horses and the speed was only 3½ miles an hour as compared with eight miles with the trucks. The 3½-ton reels of cable are rolled onto the truck with a winch, after jacks have been inserted under the frame to give it ample support while the very heavy weight is placed upon it.

Cable can be pulled through the conduits at a rate of 40 feet a minute, whereas with hand operated winches six feet a minute was good work. The brake on the winch can be stopped instantly upon signal and this prevents damage should the cable become jammed. The crew has been reduced by two men.

A detachable crane with two supporting legs is supplied by which poles can be handled either at the yards or where they are set up and taken down. For



Tri-Car with Special Delivery Body Advertising the Business of an English Dairyman.

taking up and putting in poles the crew has been reduced from 10 to six men.

For 28 days on similar work comparative costs

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were taken for horse and motor equipment and these showed a total saving for that length of time of 171 pounds, or $831.06 for the truck, an average of $29.68 a day.

ENGLISH STEAM WAGON DESIGN.

In England many of the heavy duty motor trucks are of the steam type and they burn coal or coke. It has generally been the practise to place the coal bunker behind the foot plate and beneath the body, the furnace door being behind the boiler and outside the driver's reach. Two men were required—one to drive and the other to fire the boiler.

New designs of the Mann steam three and five-ton trucks have been perfected in which the driver is able to maintain a full view of the road and still attend to the firing. In view of the present scarcity of labor in England this is an important feature.

This is accomplished by building the furnace for side feeding instead of the usual back feeding type, and the coal bunker is placed at the driver's feet. This also shortens the truck wheelbase. Both trucks are fitted with bodies equipped with mechanical dumping mechanism. Illustration of the latest Mann steam engine is shown.

ENGLISH DAIRYMAN'S AUTO CARRIER.

The odd looking vehicle which is illustrated on preceding page is a three-wheeled light delivery wagon used by F. W. Pavey, a dairy farmer of Kingston-on-Thames, for the delivery of butter, dairy products and eggs to his customers in London.

It carries a large churn, which is seen standing at the front end of the vehicle, and has receptacles for butter and eggs. It is operated at a cost of from four to six cents a mile, which includes depreciation. It is neatly finished and has a most attractive appearance, so it is a good advertisement for the owner's business. The driver is protected from the weather by a top.

SUNBEAM MAKES AEROPLANE ENGINES.

The English Sunbeam Company, of which Louis Coatalen is chief engineer, is devoting itself largely to the production of aeroplane engines for the English admiralty and army. Before the war the typical aeroplane engine was one of large cylinder capacity, low speed and low compression. Coatalen believed that the high efficiency principles employed in racing motor car engines would greatly improve it. He therefore built experimental engines of eight and 12 cylinders of the V type with high speed, high compression characteristics. These engines reach their greatest efficiency at 2200 revolutions a minute. The eight-cylinder engine is rated at 150 horsepower and the 12-cylinder at 225 horsepower. Owing to the fact that they are much more economical of gasoline per horsepower delivered, a smaller supply need be carried than with other types of aeroplane engines, and the weight for the amount of work done is much reduced. With the water, oil and gas tanks filled with one hour's supply the weight of the motor per brake horsepower is 5.1 pounds.

TRADE CHANCES AFTER WAR.

Articles wholly or partly manufactured, as well as large quantities of raw materials, will be needed by the nations at war as soon as peace has been declared. American consuls are preparing as complete and accurate a list as possible of the trade opportunities which will at that time be open to Americans and manufacturers in this country will be urged to have stocks ready for immediate shipment.

BOSTON-HARTFORD TRUCK RECORD.

A Buick truck, loaded with 1800 pounds of goods, was recently driven, in the course of ordinary business from Hartford, Conn., to Boston, a distance of 125 miles, in four hours and 45 minutes.

The truck was freighted with goods at Hartford and the driver told that the shipment was by truck because it was a rush order and express or freight were too slow. He was left to himself as to the time he should make. On the way he had to drive through the traffic of several large cities.

CHANGES IN CHASE BRANCHES.

F. B. Porter, manager of the New York branch of the Chase Motor Truck Company for nine years, has resigned to enter another business and has been succeeded by J. A. Iness, until recently head of the company's branch in Philadelphia. C. E. Collard, formerly with the New York office of the Chase organization, succeeds Mr. Iness as Philadelphia branch manager. These changes are in line with the Chase policy of making promotions within the organization instead of going outside.

Commercial vehicle licenses to the number of 2610 were issued by the secretary of state of Michigan from Jan. 1 to June 30. Of these 111 were electrics. There were 102 makes on the list. The I H C was represented by 324, the GMC by 259, the Federal by 228, the Republic by 127, the Universal by 144, the Packard by 120, the Commerce by 117, the Reo by 82, the Durant Dort by 91, the Horner by 61, the Detroit, the G. V. and the Baker, all electric machines, were represented by 55, 16 and 22 respectively.

Up to Aug. 30 there were 7453 trucks registered in the State of Pennsylvania. The total number of vehicles, including passenger cars, was 138,406, with a total valuation of $138,406,000, this representing an average value of $1000 per vehicle.

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SAVING OF GOOD CARE.

Practical Result of Systematic Attention and Careful Driving of Trucks.

To show the difference in results secured with the same trucks by different drivers, and to emphasize the value of good men and the need of giving them ample time to properly care for their machines, J. L. Black, superintendent of motor equipment for C. Feigenspan, Inc., of Newark, N. J., recently gave figures showing costs for three Pierce-Arrow trucks used by his company.

The trucks are similar. They went into use at the same time and have been driven about the same number of miles.

	No. 1	No. 2	No. 3
Gas	$ .0463	$ .0527	$ .0367
Oil	.00248	.00373	.00231
Repairs	.0293	.0315	.01384
Tires	.0538	.0532	.0523
Total	$ .13188	$ .14113	$ .10515

The driver of truck number three is a very conscientious and methodical man. His expense is consistently lower than the other two drivers and amounts in the aggregate to a saving of nearly four cents a mile. When his machine was taken down for a general overhaul it required less than half the replacement of parts on account of wear that was necessary for the other two trucks.

Mr. Black said that indolence, indifference, ignorance and lack of time to thoroughly care for a truck were the cause of most of the abuses. Ignorance is the easiest difficulty to remedy. Indolence and indifference can be overcome by changing drivers, and lack of time by giving the driver a certain portion of each working day to devote to the care of his truck.

AN 80-ACRE FARM WITHOUT HORSES.

G. T. Wyckoff of Crivitz, Marinette county, Wis., operates an 80-acre farm without a horse. He has a tractor with which he does all his farm work and which was used exclusively to clear it. He has an automobile in which he makes his necessary trips to town, and when a large quantity of produce must be moved he hitches two or three wagons together and hauls them with the tractor. He had the largest acreage planted with certified seed potatoes of any farmer in Wisconsin, planting 55 acres with 500 bushels of seed.

BATHS FOR AUTO CAR EMPLOYEES.

A marble and tile room equipped with shower baths, for the workmen of the Autocar Company at Ardmore, Penn., is to be one of the features of an addition to the buildings which is now being erected. This will be located in a special wing, 30 by 40 feet, which will contain lavatories, rest and dressing rooms.

SMALL BATTERY RECTIFIER.

New Type Mercury Arc Charging Equipment Adapted for Garage Purposes.

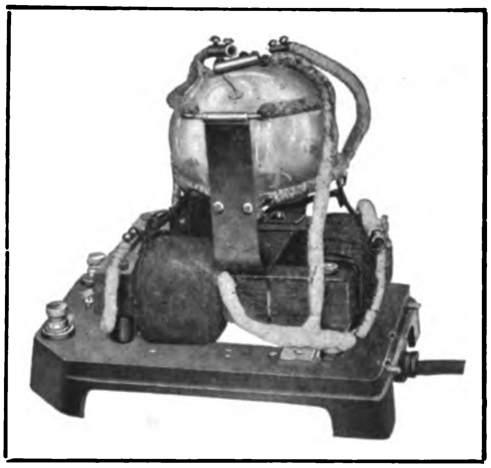
The General Electric Company of Schenectady, N. Y., is now building a new mercury arc rectifier, for charging small batteries such as are used for lighting and ignition in motor cars and motor boats, for operating electric bells, for electro plating and for numerous other uses where not over five amperes and 15 volts of direct current is required and only alternating current available.

Rocking a New Type General Electric Rectifier to Start It Charging.

The rectifier has a metal base in which are mounted reactance coils and rectifier tube in a suitable cover, the whole being encased in a perforated metal shield. It will charge one three-cell, one six-cell or two three-cell batteries. It is automatic in that it is self adjusting to any of the three conditions stated. The rectifier will charge a single battery at a rate of approximately six amperes from a 100-volt alternating current supply.

It can be furnished for 60, 50, 40, 30 or 25-cycle, 110-volt alternating circuits. The outside dimensions are 6½ inches by 9½ inches by 11 inches. The total weight of the 60-cycle rectifier is 15 pounds. So it can be carried about the garage and there is no necessity of removing the battery for charging.

To start charging it is only necessary to connect the rectifier to an ordinary light socket and connect the positive and negative poles of the rectifier to the corresponding poles of the battery. The rectifier is then tipped slightly to start the mercury in motion and no further attention is required until the battery is charged. Where two batteries are charged they should be connected in series.



The Rectifier and the Base with the Sheet Metal Cover Removed.

The cost of charging a 12-volt battery or two six-volt batteries for a 10-hour charge is about 13 cents at .10 cents per kilowatt.

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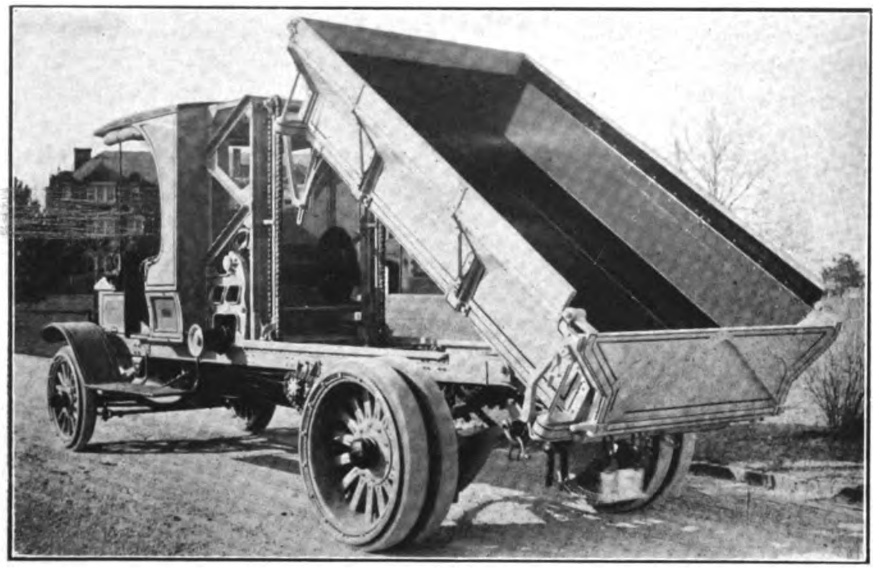
SPECIAL CONTRACTORS' TRUCK.

Five-Ton Mack Machine Equipped with Power Dump Body and Heavy Winch.

The adaptation of motor trucks to special purposes by the manufacturer to meet the demands of those whose work requires special equipment, instead of the purchasers equipping them after buying, is a policy that all of the large companies of the industry have adopted, and in many instances a prospective purchaser can obtain practically all he requires without additional cost.

This policy is practical because of the fact that in many instances a vehicle suited for one or several kinds of work can be utilized without change, and there is decided economy from the fact that a machine equipped by the builder will cost considerably less than were the owner to purchase equipment and install it, either in his own or the shops of specialists.



Mack Truck Equipped with End Discharge Dumping Body, Hoisting Drum and "Nigger-Heads" for Winding Chain or Cable, Intended for Contractors' Use.

One of the most recent examples of trucks specially designed for heavy haulage is what is known as a "general utility" machine, built by the International Motor Company, this being a five-ton Mack. The chassis is standard throughout, but to make the fullest use of its power it is equipped with a heavy frame directly behind the driver's seat. In this, in the lower section, is installed a large winding drum on which a wire cable can be wound, and which is particularly adapted for hoisting heavy weights, while at either end of the shaft of the drum are "nigger heads" on which cable or chain can be wound by holding the free end.

With this hoisting can be done from either side, a convenience that is saving of time and labor. By use of the drum heavy freight can be drawn into the body, or hoisted into buildings with block tackle, and with the "nigger heads" and a cable the truck can be extricated from soft ground by its own power or drawn up very steep ascents with a full load. The drum and the "nigger heads" can be operated with the full power of the engine.

The upper section of the frame carries the mechanism by which the front end of the body may be elevated to any desired height, an angle of 50 degrees being entirely practical for the discharge of a load of wet or bituminous material.

FEDERAL OWNERS' CONTEST.

The $300 offered in prizes to the owners of Federal trucks who submitted the best letters on "Why I Bought a Federal," is stated by Sales Manager J. F. Bowman to have produced a large number of contributions of great value to Federal salesmen, giving them exact information why Federal trucks were purchased and demonstrating facts that have decided influence with prospects.

The contest was the outcome of a visit by Mr. Bowman to a prospect who wanted to know what firms in his line were using Federal trucks and why they had bought them. When these questions were satisfactorily answered a sale was made.

These are the reasons stated most frequently in the letters that have been received by the company: Simplicity in design and construction; economy, not cheapness, in initial price; economy in upkeep and repairs; possibilities of greater work and profits; reputation of the trucks in all lines of work; stability of the company making the trucks; large production of the company makes production economies possible; an organization for affording quick and efficient service.

The contest has brought many owners in closer touch wtih the factory, which is very desirable, as they are good future prospects for trucks. In addition to the prizes, every owner who entered the contest was presented with a gold plated Federal watch chain.

The Kissel Motor Car Company has broken ground for the first of a number of additions to its plant at Hartford, Wis., which will eventually double its production. One of the new buildings is for storage and shipping, one for the enamelling department and a third, soon to be erected, is to be a four-story office building. This will house the clerical departments, executive offices and the drafting room.

Fred Cardway, lately director of the Michigan branch of the United States Bureau of Foreign and Domestic Commerce, has been placed in charge of the Packard Motor Car Company's bureau of foreign trade.

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NEW INTERNATIONAL TRUCK.

Model M Chassis Is Now Equipped with a Special Motor and Low Wheels.

The International Harvester Company of America is now building a new type model M chassis of 1000 pounds load capacity, which differs with the original model M in that it is driven by a specially designed heavy duty motor and it is equipped with wheels 36" diameter instead of the larger wheels that were characteristic of this machine. The vehicle has been very carefully designed to meet the requirements of business men who have need of light and economical delivery equipment, and statement is made that it reflects the best that engineering skill and long experience with motor trucks could suggest.

From the viewpoint of the company the machine is regarded as being extremely practical, having great utility, and it is so simply constructed that it can be operated efficiently and economically by average drivers. Minimum attention and care are required as compared with the needs with other machines, and simplicity makes for low operating and maintenance cost.

The motor in this chassis is a two-cylinder opposed four-cycle, water cooled, L head type, with cylinder bore of 4½ inches and stroke of five inches, having an S. A. E. rating of 16.1 horsepower, but the maker claims that it will develop 20. The motor is very carefully built, the wearing parts being made with means of adjustment when necessary. The pistons are ground to size and fitted with four ground rings. The crankshaft is high-grade steel, carefully counterbalanced and heat treated, and is mounted in large babbitt lined bearings. The camshaft is carried in liberal phosphor bronze bearings. The connecting rods are drop forged from special steel, heat treated, with babbitt lined big end bearings and phosphor bronze bearings for the wristpins.

A gear driven pump supplies lubricant to all parts of the motor. The cooling is by water circulated through the cylinder jackets and a large vertical tube radiator by a centrifugal pump. The valve cover plates are easily removable, so that the valves are quickly reached for grinding, and the combustion chambers are accessible for examination or work. The governor of the engine is sealed and cannot be changed, so that the machine cannot be abused by driving fast. The spark plugs, carburetor and all operating parts of the motor can be reached without removing a load from the body.

The drive is by chain from the gearset to the countershaft and by double chains from the countershaft to the rear wheels. The transmission gearset is selective, having two forward speed ratios and reverse, with the gears always in mesh. It is constructed with a locking device which prevents the driver shifting gears without disengaging the clutch. The gears are large and the shafts are mounted on roller bearings. The countershaft is carried on roller bearings, which are in self-aligning, grease tight cages. There is a large pressed steel brake drum outside the differential case which is so designed that it is effectually air cooled, no matter how much service is required. On this drum a wide contracting band affords effective braking influence in all operating conditions. This make is operated by a foot pedal.

The pressed steel channel section frame is suspended on full elliptic springs, the forward set being 36 inches length and 1½ inches width, and the rear set 36 inches length and 1¾ inches width, with an auxiliary cross spring above the rear axle. Easily adjustable radius rods take the driving and braking thrust. The axles are heavy steel drop forgings and are fitted with roller bearings. The wheels are wood, artillery type, 36 inches diameter, with solid side wire tires, the front tires being two inches width, and the rear tires 2½ inches width. The steering column is located at the right side, and the gear shifting and the emergency brake lever are operated by the right hand. The expanding shoes of the emergency brake operate on large drums on the rear wheels.

The wheelbase is 90 inches and the tread 56 inches. The overall length of the chassis is 144 inches. The height of the platform without load is 35 inches, and with load 33 inches. With regular equipment the inside dimensions of the body are 76 inches length and 42 inches width, with 11-inch panels and six-inch removable flareboards. The chassis is sold with either open express, covered express or special bodies. The regular equipment includes magneto, seat, fenders, two gas headlights and generator, oil dash and tail lamp, horn and full kit of tools. Special equipment includes skid chains, double top, top for front seat, combined speedometer and odometer, storage battery, Prest-O-Lite tank and glass windshield.

WHITE BUILDS TELEPHONE TRUCKS.

Three White trucks with bodies especially built to adapt them to the requirements of telephone work have been placed in the service of the Cleveland, O., Telephone Company. In these bodies are many bins in which material that must be protected are carried. All necessary tools and construction material are carried in such a way that they are easily accessible. In the winter or in bad weather a tarpaulin can be fitted over the body to protect the equipment from rain. The trucks were built and equipped by the White Company.

The steady extension for an eight-hour day for mechanics, especially in the East, may soon have an effect on the price of parts and the price of motor cars and trucks. Not only is the cost of labor increasing, but it is very scarce in mechanical lines, and many parts makers have been forced to refuse orders from new customers.

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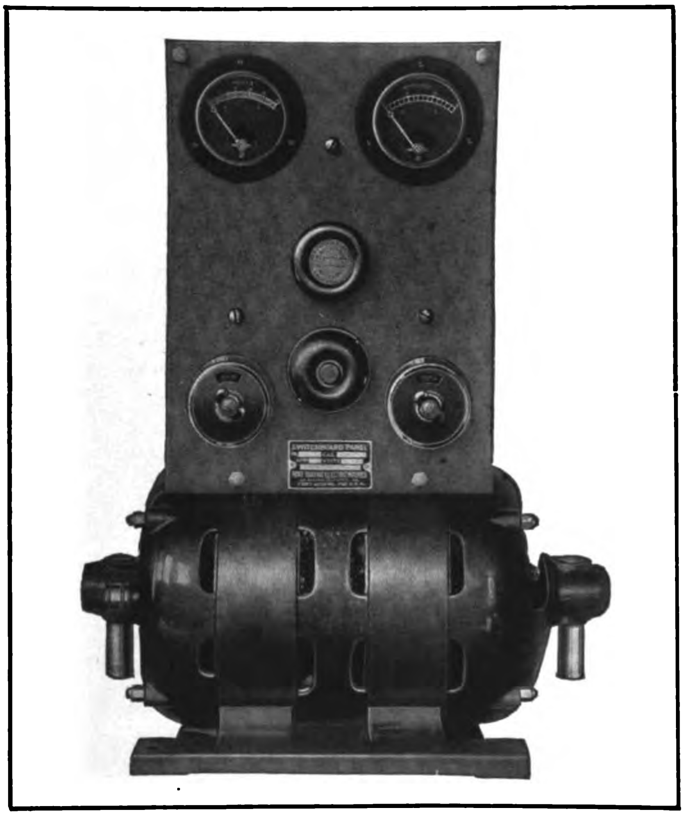
FORT WAYNE CHARGING SETS.

Portable Outfits for Small Batteries Designed for Garages or Service Stations.

Small battery charging outfits for lighting and ignition batteries for trucks, especially adapted for garage and service station use are built by the Fort Wayne Works of the General Electric Company. These consist of small motor generator sets on which are mounted switchboard panels, bearing all the switches and instruments necessary for their control.

The sets are connected with incandescent lighting circuits by means of lamp cords and plugs, the motor-generators being designed either for service on 110 or



Fort Wayne Portable Motor-Generator Set for Charging Small Batteries.

220-volt, 60-cycle, alternating current circuits, or 110 or 220-volt direct current circuits.

These outfits will deliver direct current at 12, 18 or 24 volts. There is a snap switch in the line circuit for the purpose of starting or stopping the sets, a snap switch in the circuit from the generator to the batteries which are to be charged, for opening the charging circuit, a voltmeter for reading the voltage delivered by the generator and ammeter for reading the charging current, a field rheostat for raising or lowering the voltage of the generator and for adjusting the battery charging current.

A push button between the two snap switches is provided so that the voltmeter is not in the circuit except when a voltage reading is desired. The rheostat has capacity to reduce the voltage to any point down to and including six volts.

The sets are so small they can be placed in any convenient place in a garage and on a work bench will take up very little room. They require no attention except an occasional filling of the bearing grease cups.

They are supplied in two capacities, either of 175 or 250 watt outputs.

WANT NEW TYPE OF MOTOR PLOW.

A new type of motor plow which will dig much deeper than any now in use and of which either the top or bottom spits can be reversed according to the nature of the sub-soil, is suggested by English agricultural experts as a means of increasing greatly the productiveness of the land.

The plow or trenching machine should enable manure to be placed at the bottom of the trench. The idea of the tool is to produce the same effect as deep trenching by a hand spade. This process is said to almost double the productivity of the soil, but it costs in England, even in ordinary times, when labor is plentiful, from $75 to $95 per acre.

GOODYEAR S-V GUARANTEE CONTINUED.

The Goodyear Tire and Rubber Company has continued for another six months, until April, 1916, its guarantee to refund the entire price of S-V pressed-on truck tires which are tried out on trucks in competition with other tires and fail to show a lower cost of tire mileage. Several thousand tires have been applied under this offer, according to C. W. Martin, Jr., manager of the truck tire department, and not one has failed. Mileages as high as 16,000 have been reported, but none of the tires have so far worn out. Machines for applying the tires to wheels have been placed in every city of fair size throughout the country.

WARNS AGAINST SHORT GASOLINE.

Weights and Measures Commissioner Hartigan of New York City has warned motorists that many of the gasoline stations in the city have been giving short measure and that on 10-gallon purchases a shortage of as much as two gallons has sometimes been detected. Many of these cases have been prosecuted. He suggests that each buyer carry a standard measure which has been tested with the official seal attached to make sure that he gets what he pays for.

J. M. Gilbert has been elected vice president of the Gibney Tire and Rubber Company of Conshohocken, Penn., and will manage the company's sales from a New York City office.

During the year ending Sept. 15 the Reo Motor Truck Company, Lansing, Mich., produced 1510 trucks.

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TRUCK DATA FROM EUROPE.

The Internal Gear Drive Association, Detroit, has received from Major Hamberger of the Swiss general staff an account of the experience of the Swiss army with trucks since mobilization was begun at the outbreak of the European war. The country has taken no part in the struggle, but has had 400,000 trained men under arms throughout the war.

At the start of the war the army engineers had no particular leaning toward any type of truck and vehicles of chain, cardan and internal gear drive designs were used. Major Hamberger declares that the internal gear drive has given the most satisfactory service for light or heavy hauling up to five tons.

The army is largely on the borders of the country, where the districts are mountainous. Roads are good, but grades are very heavy. For use in the mountains three-ton trucks with heavy motors of 45 horsepower are used. These are loaded to 75 per cent. of their capacity. The major comments on details of design in the internal gear drive type and makes suggestions for improvements which have been turned over to the engineers of American manufacturers who are developing the internal gear drive.

SPLITDORF PAYS MILLION FOR PATENTS.

The basic patents for the Dixie magneto were purchased recently by the Splitdorf Electrical Company, Newark, N. J., from the Sumter Electrical Company of Sumter, S. C., for a price stated to be $1,000,000. They were the invention of Charles T. Mason, president of that company.

The Splitdorf company has been building under a license arrangement 1500 Dixie magnetos a day—in types for cars from one to 12 cylinders. The great simplicity of construction of the Dixie magneto and its effectiveness of operation make it of distinct value for ignition.

The Splitdorf company will continue to manufacture magnetos for stationary engine, marine and tractor purposes—the full line built by the Sumter Electrical Company, in the Sumter plant, but the automobile, motorcycle and aeroplane magnetos will be made at Newark, N. J.

WILL SUPPLY ALL AMERICAN DEMANDS.

According to E. B. Jackson, manager of the Packard Motor Car Company's branch in New York City, American buying of motor trucks has been very conservative up to this time owing to general business uncertainty. Some sales have been made to war specialty manufacturers who have increased their haulage equipment. But with the general revival of business greater sales are expected. The Packard company has arranged its production for belligerent governments so that machines will be available for all American demands.

TRUCK COST FOR BAKER.

Result of Analysis of Use of Federal Machines by Cleveland, O., Concern.

One and half-ton Federal trucks operated by the General Baking Company in and about Cleveland, O., have been subjected to an exhaustive study by the traffic department of the Federal Motor Truck Company. The machines were equipped with service recorders, which show the number of stops made, distance between stops, time of stops and time of running. These reports, along with cost sheets, were issued every night for over a month.

The result showed a daily average for the trucks of 46.53 miles, with an average of 39 stops and a daily cost of $6.74. These results were compared with those secured by horses. The following table resulted:

	Present results with team and wagon.		Federal over same route.		What the Federal would do.	
	Hrs.	Min.	Hrs.	Min.	Hrs.	Min.
Standing time	3	40	3	40	3	40
Average time per order	0	10	0	10	0	10
Average time per stop	0	8.5	0	8.5	0	8.5
Running time—						
To first stop	0	37	0	20	0	20
Between first and last	1	45	0	50	2	59
From last stop	1	24	0	29	0	29
Total	3	46	1	39	3	48
Total standing and running	7	26	5	19	10	0

	Present results with team and wagon.	Federal over same route.	What the Federal would do.
Mileage	Miles	Miles	Miles
To first stop	4	4	4
Between first and last	10	10	40
From last stop	6	6	6
Total	20	20	50
Average distance between stops	0.4	0.4	0.9
Speed	Miles per hour	Miles per hour	Miles per hour
To first stop	6.5	12.22	12.22
Between first and last	5.7	13.35	13.35
From last stop	4.3	12.38	12.38
Average	5.31	13.18	13.18
Delivery—			
Orders	22	22	37
Weight	1300	1300	3000
Stops	26	26	43
Weight per order	59	59	59
100 lb. miles	130	130	750

AVERAGE DAILY COST OF OPERATING 1½-TON FEDERAL.

Amount invested........$1950.00 (chassis and body)

Fixed charges	Cost per Year	Cost per Day
Interest at six per cent	$117.00	$ .39
Insurance*		
Liability	45.00	
Property damage	18.00	
Fire**	26.25	
	$ 89.25	$ .30
Taxes***	30.00	.10
Driver		2.50
Garage		.25
Total		$3.54

*Michigan insurance.
**$17.50 per 1000—$1500 val.
***$20.00 per 1000—$1500 val.

OPERATING COST.

	Per Mile
Depreciation*	$0.0125
Gasoline**	0.0131
Oil (125 M. P. G. at 50c per gal.)	0.0040
Repairs and maintenance inc. repainting	0.0190
Tires (cost $181.00—guaranteed 8000 miles)	0.0226
Total	$ 0.0712

*Second hand val. $700 at 100,000 miles.
**10½c per gallon, eight miles per gallon.

Average costs are figured on a basis of 307 working days per year.

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COST PER DAY.

Miles	20	25	30	35	40	45	50
Fixed charges	$3.54	$3.54	$3.54	$3.54	$3.54	$3.54	$3.54
Variable charges	1.42	1.78	2.14	2.49	2.85	3.20	3.56
Total	$4.96	$5.32	$5.68	$6.03	$6.39	$6.74	$7.10
Cost per mile	.248	.212	.189	.172	.159	.149	.142

URGES STARTERS FOR TRUCKS.

Russell Huff, consulting engineer of the Packard Motor Car Company and president-elect of the Society of Automobile Engineers, believes that every truck should be equipped with an electric starting and lighting system.

The starter has been so far perfected that it may be installed on a truck and forgotten, he said recently. It removes the tendency of the driver to allow his engine to idle while the truck is standing still. This costs about one gallon of gasoline an hour for a three-ton truck and uses much lubricating oil. Idling engines pull more oil into the cylinders than they need and make an engine carbonize much more rapidly. Excessive idling in cold weather is also often the cause of engines starting hard. Electric headlights and a swivel searchlight are great aids in making deliveries by truck after dark. Electric lights can be cheaply installed in van or covered bodies and are often a great convenience for loading and unloading.

TIRE MILEAGES HAVE INCREASED.

Five years ago users were satisfied with an average tire mileage of about 3500 miles; now 6000, 8000 or even 10,000 miles are expected and received. One of the big reasons for this increase, in the opinion of L. C. Rockhill, manager of the automobile tire department of the Goodyear Tire and Rubber Company, is the fact that the tire companies have succeeded in educating the user in the proper method of caring for tires. Better tires are made. And both manufacturers and users have learned more about the right tire capacity to carry a given load so that cars which in the past used tires that were much undersized are now equipped with shoes that fully endure.

MACMANUS WITH ERWIN & WASEY.

Theodore F. MacManus, one of the best known automobile advertising men in the United States, has become vice president of the Erwin & Wasey Company and will be in charge of its Detroit office. He will continue to direct the advertising of the Cadillac, Dodge and Hupmobile companies, and in addition will devote much of his time to the great Goodyear Tire and Rubber account. Mr. MacManus first became prominent as a partner of Martin V. Kelley in the MacManus-Kelley Company of Toledo. Later he formed the MacManus company of Detroit, and after that for a year was connected with the Detroit office of the Dunlap-Ward Company.

The Erwin & Wasey Company is a new firm, made up of men formerly with Lord & Thomas of Chicago. Charles E. Erwin, president of the company, was president of Lord & Thomas, and Louis R. Wasey and W. T. Jefferson, the other two partners, were directors. The agency is now one of the largest in the country. Business amounting to $2,000,000 a year will be placed through the Detroit office and a very large volume will be placed from Chicago.

Many of Mr. MacManus' associates in the Dunlap-Ward Company go with him, including Gerald Page-Wood, formerly of Fuller & Smith, Cleveland, O., as art director. Mr. Page-Wood handled the art work for the Timken and National Mazda lamp campaigns.

MEAD JOINS FEDERAL FORCE.

E. E. Mead, for a number of years manager of the service factory and the business of the service department of the Packard Motor Car Company, has joined the Federal Motor Truck Company in the capacity of factory manager. He was with the Packard company from its organization 12 years ago, and before that he was with the firm out of which the Packard company was developed.

He will have full charge of the present factory of the Federal Motor Truck Company and will direct the research and engineering work, of which the Federal company plans to do a great deal. He will have charge of designing and erecting new buildings along efficiency lines. It is announced at the same time that the Federal company has bought five additional acres of land adjoining its plant and the building of extensive additions will start soon that the company can keep pace with rapidly increasing business.

TRACTION LINES OPERATE 'BUSES.

In view of the strong favor of the Baltimore public for motor 'buses, which is shown by its patronage of a 'bus line operated on Charles street by the Paye company, the United Railways and Electric Company has organized a 'bus operating company known as the Baltimore Transit Company, and has established a service over the same route.

Twenty-five one-ton Garford chassis have been purchased and these have been equipped with 'bus bodies built by the J. G. Brill Company of Philadelphia. The purpose of the company is to fight competition of the independent 'bus lines. The purchase of so large a number of 'buses indicates the belief that 'buses have become a permanent means of transportation in the city.

George H. Duck, former president of the Motor Truck Club of America of New York City, has been made general sales manager of the United Motor Truck Company, Grand Rapids, Mich.

W. F. Jolley has resigned as sales manager of the Troy Wagon Works of Troy, O.

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TIFFIN MOTOR DRIVEN FLUSHERS.

PROMINENT in the displays of the national exhibition of city service and sanitary equipment at New York City this month were "Tiffin Motor Driven Flushers," machines designed to do work until now only accomplished with combinations of vehicles when a high standard of sanitation was to be obtained. The exhibition was to demonstrate the endeavor of those manufacturing such equipment to meet the growing demands of municipal authorities for specialized apparatus, designed to afford the service exacted by scientific sanitation.

While differing types of street flushers have been built for years, and in this classification can be included automatic flushers and apparatus of moderate capacity with motor power to obtain pressure, the Tiffin Wagon Company, Tiffin, O., a pioneer builder of city service equipment, has developed and showed what is claimed to be the first really successful power flusher on a motor truck chassis.

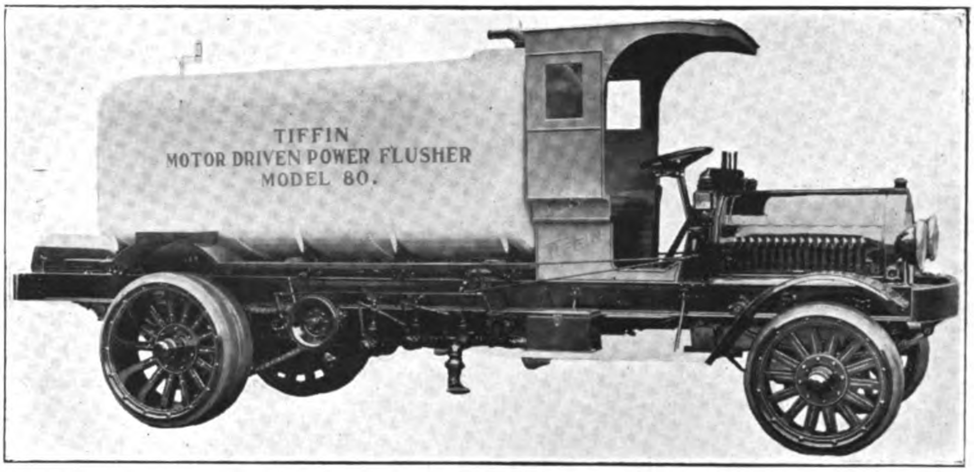
The need of this apparatus has been manifested for a considerable period, for "automatics" have limited capacity in favorable conditions, which means high city water pressures, for as water pressure is lessened in the same ratio is efficiency lowered. The new machines are built with capacities of 1000, 1200, 1400 and 1500 gallons.

In construction these flushers are much the same, each having two power plants—the one for moving the vehicle and the other to supply the water pressure. In the tests made with the machines in West End avenue daily during the exhibition, which were witnessed by municipal officials from all sections of the country, the principle was demonstrated to be correct.

The reason of the makers for two power plants is that this construction affords any desired water pressure without regard to vehicle speed that the apparatus may be driven, according to requirements for street or grade, without changing the water head, this being constantly maintained by the independent motor at the rear of the chassis. When motor driven flushers have but one motor the water pressure is changed with the varying speed of the machine. To have slower pace and a high water pressure charge must be made to a lower gear ratio. This does not afford the uniformity of flushing practical with a two-motor construction.

Another result is that two motors are more economical than one, in that the pump is only operated when needed, and when not flushing the vehicle motor is only using the power necessary for driving it. This is a decided fuel economy. Not only this, because of the two engines the apparatus may be dismantled and used for other purposes when not required for flushing, this obviating the necessity of storing an expensive apparatus during the late autumn, winter and early spring.

The Tiffin motor driven flusher that attracted the greatest attention was the largest size machine, this being built at the factory at Tiffin, together with all its equipment. The chassis is a six-ton truck type, having a six-cylinder Continental engine installed under a hood forward of the dash, the power being transmitted through the rear wheels, the purchaser having the option of either worm or chain drive. The motor for the water pressure system is a four-cylinder Continental, installed at the rear of the chassis, and this drives a 2½-inch centrifugal pump that will deliver 250 gallons a minute at any pressure up to 70 pounds. Both engines may be started from the seat, as a starting and lighting system is regular equipment of this vehicle.



The Tiffin Motor Driven Flusher, a Two-Engine Equipment, That Will Maintain Water Pressure Independent of the Vehicle Speed.

The discharge for flushing purposes is so arranged that the entire width of an ordinary street can be flushed at one operation. There are four nozzles, two at either side, both forward and amidships, which can be operated singly or in any combination. Sprinkling nozzles are also of the equipment which are interchangeable with the forward flushing nozzles, so that both flushing and sprinkling can be done. Provision is also made for the machine for drawing water from rivers and creeks where hydrant filling is not possible.

The large capacity and increased efficiency of these machines are so certain advantages as compared with other types, and as power flushers are absolutely independent of prevailing city water supplies, there appears to be a very wide use for them in the municipalities that are progressive.

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ENTHUSIASTIC ELECTRIC VEHICLE CONVENTION.

THREE hundred men whose interests are vitally involved with the fate of the Electric Vehicle Industry, met at the convention of the Electric Vehicle Association of America at the Statler hotel, in Cleveland, Oct. 18 and 19. About one-fourth were central station men, one-seventh vehicle manufacturers and the remainder battery and accessory representatives.

As at most of the recent conventions the subject of co-operation between the central stations and the vehicle manufacturers was given great prominence in the addresses and there were evidences that much greater endeavor in this direction is to be made in the near future.

The paper by I. S. Scrimger of the Detroit Taxi Cab Company, which has been pioneering electric taxi cabs, convinced the convention that the taxi cab business is one field in which the electric vehicle has an excellent opportunity to completely replace the gas car and concentrated effort along this line will doubtless characterize the immediate future of the industry.

The Taxi Cab Situation.

Mr. Scrimger said that with the best management the cost of operating a gasoline car in the taxi cab service in Detroit had been from 30 to 35 cents a mile, while the revenue received was about 33 cents per mile. This condition, he said, was general throughout the United States and the cab companies faced the alternative of going out of business or of finding some cheaper vehicle.

When his company decided to try the electric he found the manufacturers unwilling to supply anything but their standard chassis, so the taxi cab company decided to build its own cars. The first car so built went into service June 25, 1914. No announcement was made and as the car looked much like a gasoline cab, many of its first passengers did not know that it was an electric. Letters of approval began to arrive and the cab was soon proved a distinct success, many passengers waiting for the electric, and others like it that followed, rather than ride in a gas cab.

Eleven more cabs were built and went into service in December, 1914. Fifteen additional cabs are just being completed. By the first of January the company will be operating 47 electric cabs.

The cabs now in service are being operated 24 hours a day, with two drivers. In the sidewalk in front of all the hotels charging sockets have been installed, so that the batteries can be boosted while the cabs are waiting for passengers. The operating cost for these cabs up to the present has averaged about 20 cents, reducing the gas cost 13 cents a mile. The business has been converted from one that just barely paid expenses to one that is profitable.

One of the most important steps of the convention was the passage of a resolution looking toward closer co-operation with the National Electric Light Association. The steps in this direction may eventually lead to the amalgamation of the two associations.

Electric Service a Handicap.

A great handicap on the growth of the business was held to be the lack of proper electric garages and the facilities for service. George H. Kelly in his impromptu talk laid great stress on this fact. He said it was not hard to sell electric vehicles, but that under present conditions it was hard to keep them sold or get repeat orders. While there are 150 good gas car garages in Cleveland, he said there were only a dozen electric garages.

He said that the electric had more speed than could be legally used in any city, that it had a range of operation greater than was ordinarily required of the gas car, and was perfectly fitted for 99 per cent. of city uses. He said there was necessity not only of educating the public, but the electric vehicle makers themselves to these facts. Proper charging stations must then be supplied and expert men for battery work must be had. He emphasized the point that in the arrangements for giving service to the cars after they have been sold the central station men can be of great assistance.

It was the sentiment of many of the speakers that it is very bad policy for the electric makers to attempt to sell their cars for purposes that can be more cheaply and better served by other types, and that it is not right to insist that central stations use electrics for such work.

Current Rates Are Variable.

In a tabulation of rates for current covering New England a very wide variation was shown as to rates and classifications. Some of the rates are on a sliding scale, some companies have no special rates and some have elaborately classified rates.

A paper on the battery service system of the Hartford Electric Light Company showed that the operation of the system had doubled the number of trucks in use in three years and had greatly increased the vehicle mileage and the amount of current consumed.

The following officers were elected for the ensuing year: President, W. H. Johnson, vice president of the Philadelphia Electric Company; vice president, E. S. Mansfield, superintendent operating bureau of accounts Edison Electric Illuminating Company of Boston; treasurer, H. M. Edwards, auditor New York Edison company, New York; directors, W. H. Blood, Jr., Stone & Webster Management association; P. D. Wagoner, president General Vehicle Company, Long Island City; G. H. Kelly, secretary-treasurer of the Baker-R & L Company, and J. F. Gilchrist, vice president Commonwealth Edison Company, Chicago, Ill.

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EXPERIENCE of more than 14 years, beginning with pioneering in the motor vehicle industry, is claimed to be represented in B. A. Gramm's trucks, which are built by the Gramm-Bernstein Company, Lima, O., and are in five different sizes—5-6 ton, 3½-ton, 2½-ton, 1½-ton and one-ton capacities. These machines are very carefully designed with the purpose of obtaining extreme endurance and efficiency, as well as operating economy.

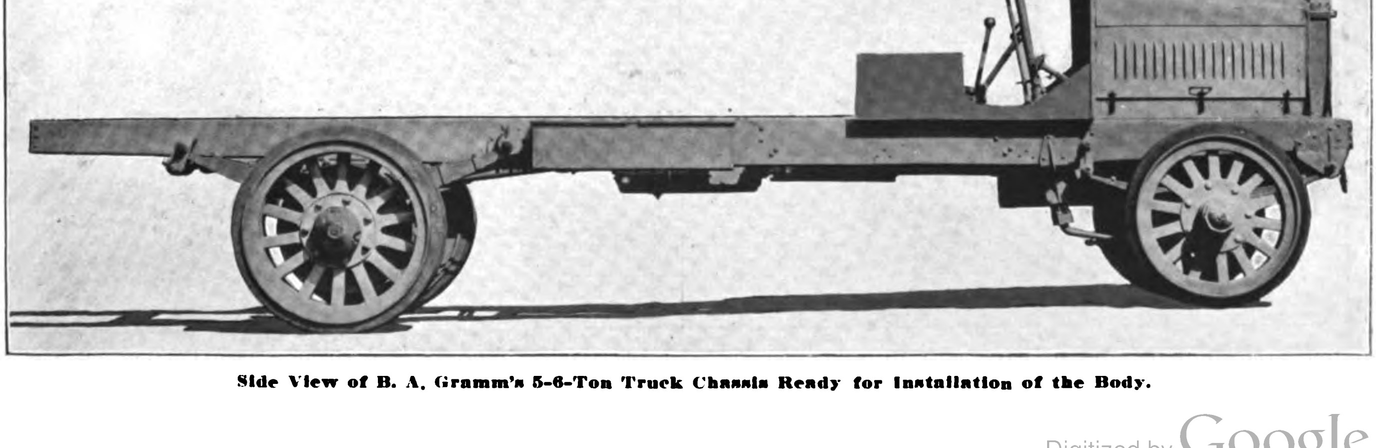
They are built of some of the best known products of the industry, and include Waukesha motors, Sheldon semi-floating overhead worm shaft and gear wheel rear axles and Ross steering gears, all of the other components being of equally high quality. The endeavor in designing has been to produce what will be perfectly balanced machines, that have ample power, that are simplified and so accessible that the labor necessary for attention and care is minimized. No radical change has been made in design or construction from what is accepted as standard by the motor vehicle industry, and while these trucks represent the best proven developments, they have nothing that can be regarded as experimental.

They are built in a factory that has exceptional facilities for producing economically, the equipment having been selected with a view of minimizing production cost, and great care has been taken to build vehicles that are known to be up to a high standard. Strength and endurance has been obtained by the use of special metals and by careful proportioning, and provision has been made to afford complete lubrication, as well as protecting all moving parts from abrasives. Where there will necessarily be wear means of adjustment and renewal have been provided.

Three Sizes Waukesha Engines.

The Waukesha motors used in B. A. Gramm's trucks are three different sizes. They are all long stroke, heavy duty types, specially designed for truck service, and aside from proportions are identical in construction. The smallest has cylinder bore of 3½ inches and stroke of 5¼ inches, and is rated by the S. A. E. formula at 19.60 horsepower; the intermediate size has cylinder bore of 4¼ inches and stroke of 5¾ inches, and is rated at 28.90 horsepower, and the largest size has cylinder bore of 4½ inches and stroke of 6¾ inches, and is rated at 32.4 horsepower. The ratios of the bore to stroke of these engines are respectively 1:1.5, 1:1.353 and 1:1.5.

There is no question that the longer stroke adds power, though there is no general standard by which this added power can even approximately be determined. For practical purposes one can reasonably assume that the power of a well designed engine in excess of the S. A. E. rating is proportionate to the ratio that the stroke exceeds the bore when worked to what may be regarded as a reasonable operating maximum, which would give horsepower production for these three engines of 29.40, 38.70 and 48.60 respectively.



Side View of B. A. Gramm's 5-6-Ton Truck Chassis Ready for Installation of the Body.

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B. A. Gramm's 5-6-Ton Truck Chassis Equipped with a Power Hoist and End Discharging Body.

The power ratings of manufacturers usually exceed the S. A. E. figures, which do not regard the stroke, and are frequently the result of brake tests. Full capacity, however, cannot be expected unless the engine is well maintained and is efficient from every viewpoint.

Design of Engines Identical.

The smallest engine is installed in the one and 1½-ton trucks, the intermediate size in the 2½ and 3½-ton trucks, and the largest in the 5-6-ton trucks. Because the design of the engine is practically standardized a description of the large type will be sufficient, as it will apply to all save in dimensions. The engines are four-cylinder, four-cycle, water cooled, vertical, L head types, with the valves at the left side. They are simply designed, extremely accessible for inspection or work, and great care has been taken to have the construction enduring.

The cylinders are cast in pairs from high-grade, semi-steel, with large water jackets integral. Webs are cast on the valve sides of the cylinder units beneath the valve pockets and on the base flanges to enclose the valve mechanism. The covers of the water jacket heads are large, this construction insuring complete freeing of the water passages and thorough circulation of water. Unusual care is taken in machining and finishing the cylinder units to obtain accurate fit of the pistons, and five tests are made during the work to guard against imperfections.

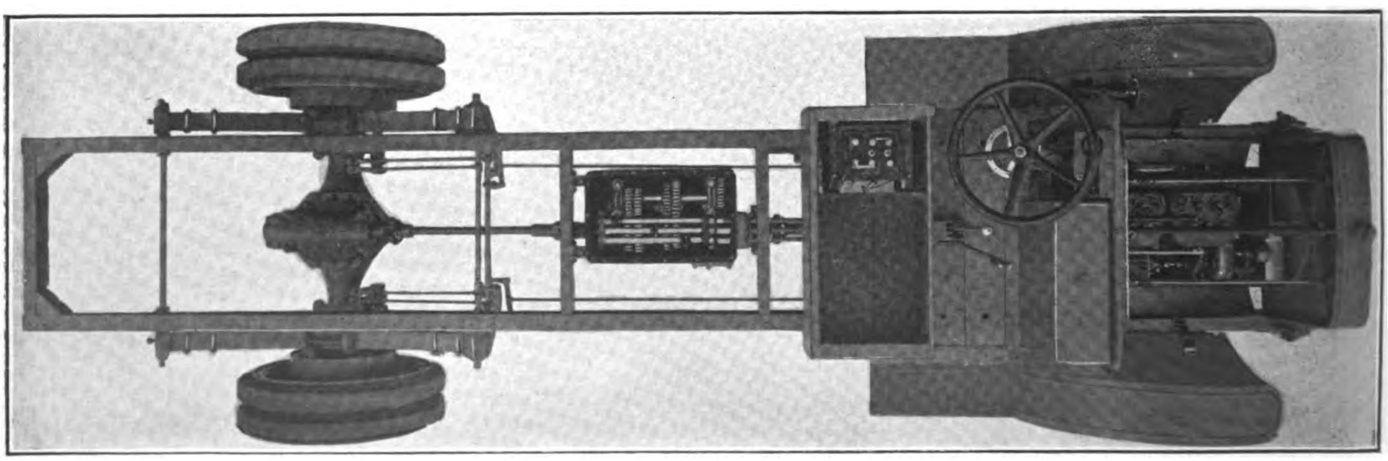
The Pistons and Crank Case.

The pistons are cast from semi-steel and turned carefully to insure accurate fit. Each piston is fitted with ¾-inch eccentric compression rings. The crank case is cast of copper aluminum alloy in two sections, being divided horizontally. The casting is heavy to obtain rigidity, the minimum thickness being ⅜ inch. The upper section is divided by a transverse vertical web that carries the centre main bearing. The lower section is divided by a horizontal web in which are the oil troughs for the splash of the connecting rods, while below this is the oil reservoir.

There is a forward extension of each section to form a housing for the timing gearset, which is completed by a large cover plate. Supporting arms, two at either side, are cast integral with the upper section of the crank case, and in this section, at the left side, are two large cover plates that are retained by a quickly removable clamp. In the rear plate is a breather and lubricant filler. By removing these plates one has immediate access to the connecting rods and main bearings for inspection or work, there being no reason for taking off the base section of the crank case unless for an overhaul.

Crankshaft and Connecting Rods.

The crankshaft is a drop forging of chrome nickel steel, hardened, ground and heat treated. It has a tensile strength of 140,000 pounds to the square inch and an elastic limit of 118,000 pounds. The shaft is two inches diameter at the bearings and crankpins, and the main bearings are 3½, 4¼ and 4½ inches length



Top View of B. A. Gramm's 5-6-Ton Chassis, Showing the Transmission Gearset Case Open.

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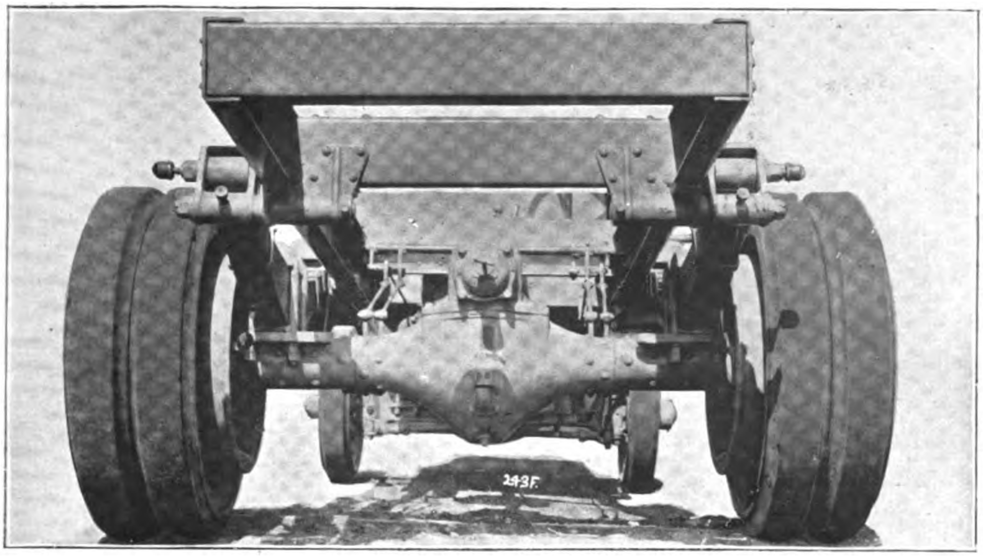


View of Rear End of B. A. Gramm's 5-6-Ton Truck Chassis, Equipped with Sheldon Semi-Floating, Worm Driven Axle.

respectively from front to rear, having a total bearing length of 12¼ inches. The main bearings are high-grade babbitt metal, carried in bronze cages. The camshaft is a steel drop forging with the cams integral that is finished 1¼ inches diameter, and is heat treated and ground. This is mounted in three babbitt metal bearings fitted to bronze shells.

The connecting rods are I sections, drop forged from 35 carbon steel, heat treated to obtain strength. The big ends bearings, three inches length, of Fahrig metal, are backed with bronze and fitted with shims. These rods have caps that are retained with four alloy steel bolts, each having two nuts, the outer nuts being castellated and pinned with cotters. The wristpins are steel tube, 1½ inches diameter, case hardened and ground. These are secured in the bosses of the pistons. The phosphor bronze bushings in the small ends of the connecting rods, that oscillate on the pin, are 2¾ inches length.

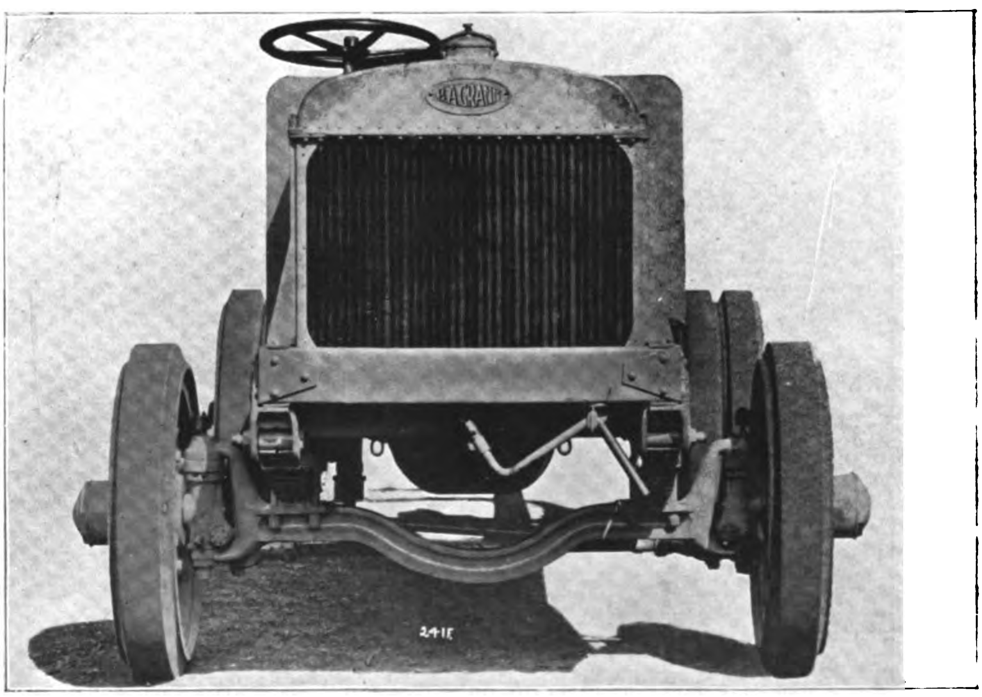
The timing gearset gears are 35 carbon steel with inch faces, helical cut and heat treated. They are noiseless in operation, and can be reached by removing the bolts that retain the cover plate of the housing. The engine governor incorporated with this gearset is the Waukesha patented construction, which is non-hunting and self-lubricated, and can be adjusted to a definite maximum speed and is sealed.

The valve mechanism is conventional, the camshaft lifting the valve tappets, which are a roller type, 1⅛ inches diameter tube, case hardened and ground, that are fitted with adjusting screws and lock nuts. These operate the valves, which are 3½ per cent. nickel steel, 2⅛ inches clear diameter and have case hardened stem ends. Both the tappets and the valves operate in liberal guides that may be renewed when worn.

The engine is lubricated by a combination force feed and splash system exclusive with Waukesha designs, in which the connecting rods establish the oil level regardless of the position of the motor. The oil is circulated by a pump, consisting of a case and two small spur gears running in mesh, driven by a vertical shaft that is in turn driven by spiral gears from the rear end of the camshaft. The oil is drawn through a filtering screen and forced through ducts inside the crank case to the main crankshaft bearings, and the overflow from these drains over the timing gears and to the troughs in the base of the crank chamber. The distribution is by splash of the connecting rods to the cylinders, pistons, wristpins, camshaft, cams and valve tappets. Drainage from the troughs is to the reservoir.

Cooling and Ignition Systems.

The engine is cooled by water forced through the engine jackets by an all bronze centrifugal pump that has a large shaft and bearings, and through a finned tubular radiator that is a built-up type, with cast top and bottom tanks and water columns surrounding the central section or core. The radiator is mounted on the frame, this making a rigid support. At the back



Front End View of B. A. Gramm's 5-6-Ton Chassis, Showing the Axle and the Radiator Construction.

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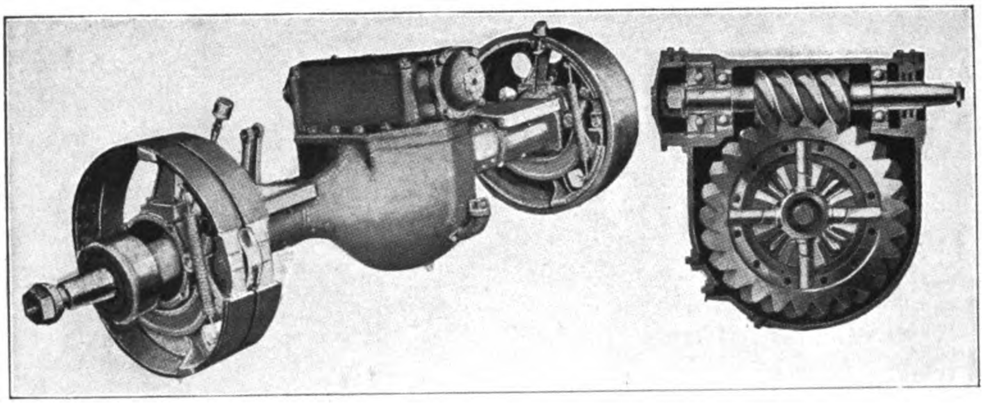


Sheldon Semi-Floating Worm Drive Axle and the Shaft and Gear Wheel Used in B. A. Gramm's 5-6-Ton Truck.

ing and a steel plate carrying a stub shaft that projects through the cover. On this shaft is a ball thrust bearing. The clutch is disengaged by pressing a foot pedal coupled to a shaft that carries two levers or fingers, which in turn through pressure on the ball bearing and the cover compresses the spring and separates the discs. Where the clutch shaft projects through the housing is a bronze bushing with graphite inserts that keep the bearing effectually lubricated. Because of the very large area of the frictional surfaces of the discs in contact. 471 square inches, the clutch is unusually efficient and enduring.

of the radiator is a sheet metal shield or shroud with an opening in the centre in which a 20-inch cast aluminum fan is operated, this causing a very rapid draft of air through the radiator, which effectually cools it. The fan is driven by a flat leather belt from a pulley on the water pump shaft. The fan spindle is stationary, but the belt tension is adjusted by an idler. The water capacity of the system is 9½ gallons.

The fuel is supplied through a Zenith carburetor, and the ignition system is a Bosch high-tension magneto that is used duplex with batteries for starting. The ignition point is variable. The system has a vibrator and coil for starting on the batteries so adjusted that when the engine is turning more than 200 revolutions a minute it will "skip," so that the driver will be compelled to change to the magneto to have the engine run smoothly. This is to prevent unnecessary use of the batteries.

Special Type Dry Plate Clutch.

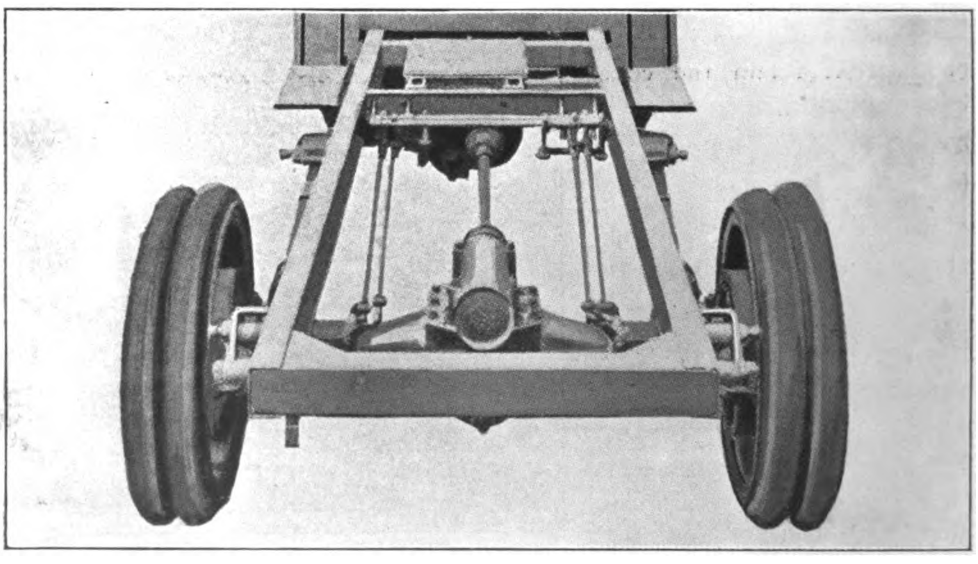
The clutch is a dry plate multiple disc type. The core is grooved on its outer circumference. Upon this core are mounted four steel discs having projections that fit into these grooves. The discs are 13¼ inches diameter and ⅛-inch thickness, faced on either side with wire asbestos fabric. The core is mounted on the extension of the crankshaft on an annular ball bearing. This bearing is packed with vaseline when assembled. On the internal periphery of the flywheel are fitted six hardened steel keys, spaced equidistant, the ends of which are anchored in the flywheel web and in the cover that fits on to the flywheel rim, the flywheel being the housing of the clutch.

Alternating with the discs of the core are three other discs that have slots in the peripheries to fit the keys inside the flywheel rim. These are 3/16-inch thickness. These discs are normally compressed by a spring making 300 pounds pressure, placed between the steel cover of the clutch hous-

The Fool Proof Gearset.

The gearset of the power transmission system is a design patented by the company and constructed in its shops. Claim is made that it is absolutely fool proof and that it cannot be damaged by the most careless or incompetent driver. It is an individual or dog clutch construction, a selective sliding gear type with the gears always in mesh, having four forward speed ratios in the 5-6 and 3½-ton chassis and three forward speed ratios in the 2½, 1½ and one-ton chassis.

All the gears are high carbon chrome nickel steel, accurately cut and carefully heat treated to insure an absolute standard of quality, each gear being tested at three points by scleroscope for hardness. Those not equalling the initial requirements are treated to obtain the exact physical condition required. The dog clutches are similarly treated. The gears are five pitch, 1¼ inches face. Each gear on the splined shaft is mounted on a ball bearing. The shafts are chrome nickel steel and are carried on annular ball bearings of ample size. At the rear end of the gearset the main shaft is mounted on a double row annular ball bear-



Rear End of the B. A. Gramm's 5-6-Ton Truck Chassis, Showing the Frame Construction and Power Transmission System.

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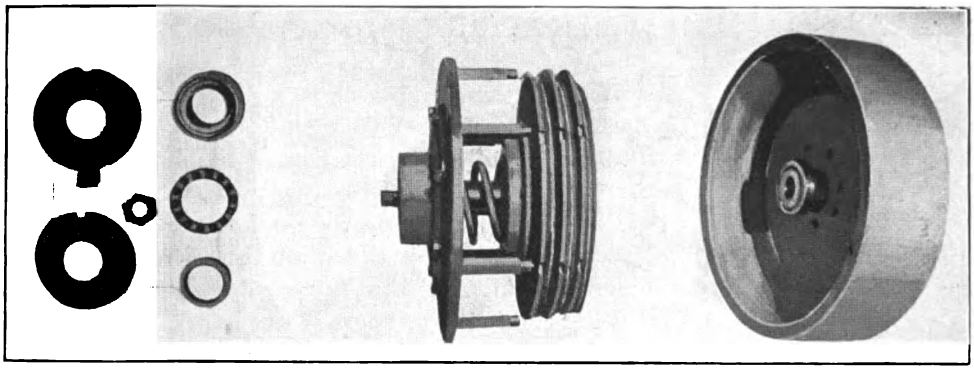

The Components of the Multiple Dry Plate Clutch Used in B. A. Gramm's Trucks.

ing to absorb the end thrust.

The gearsets are made with two different speed ratios, and two different gear reductions are provided for the rear axles. These are as follows:

Gearset Ratios	Gearset Reduction	Axle Reduction	Total	Axle Reduction	Total
1	4.93:1	13:1	64:1	11.75:1	58:1
2	2.93:1	13:1	38:1	11.75:1	34. 5:1
3	2.07:1	13:1	27:1	11.75:1	24. 3:1
4 (direct)	1:1	13:1	13:1	11.75:1	11.75:1
Reverse	4.32:1	13:1	56:1	11.75:1	51:1
1	3.38:1	13:1	44:1		
2	2:1	13:1	26:1		
3	1.42:1	13:1	18.5:1		
4 (direct)	1:1	13:1	13:1		
Reverse	2.96:1	13:1	38.4:1		

Semi-Floating Type Rear Axles.

From the gearsets the drive is through shafts with universal joints at the forward ends to the Sheldon overhead worm and gear wheel of the semi-floating rear axles. The axle housings are cast steel, the central sections having heavy cover plates on which are mounted the worm shafts and the gear wheels and the bevel gear differential assemblies. The worm shafts are mounted in large ball thrust and radial load bearings. The nickel steel axle shafts are respectively 3¾, 3⅜, 2¾, 2⅜ and 2 3/16 inches diameter, and they are carried in heavy bearings. The end sections of the axle housings carry the spring seats, which have very liberal areas, and the brackets for the shafts for the two sets of brakes.

The inner ends of the axle shafts, carried on the bearings of the differential assembly, are hexagonal and are smaller than at any other point. Should an axle break it will fail just outside the differential case, and in such an event the axle cannot drop. The spindles and the differential are carried on double-row annular ball bearings. The outer ends of the axles are tapered and the wheels are retained by keys and nuts. The worm is alloy steel and the worm wheel is special bronze. The worm wheel is operated in a bath of lubricant.

The frames of the three largest size chassis are pressed steel and those of the two smaller sizes of rolled steel channel, strongly reinforced and gusseted. The overall lengths of the frames are respectively 261, 233, 225, 203 and 179 inches length, and these afford loading spaces that are 162, 144, 136, 114 and 90 inches length. The frames are suspended on semi-elliptic springs, the rear sets being mounted outside the frames. The forward ends are pivoted to substantial hangers and the rear ends are shackled, the construction being the well known Hotchkiss design, the drive being through the springs. No radius rods are used, the traction and braking stresses being taken by the springs, a European practise that has been adopted by a considerable number of American makers.

Springs and Steering Gear.

The forward springs of the trucks in order of sizes are 48 inches length and 3½ inches width, 44 inches length and three inches width, 44 inches length and three inches width, 42 inches length and 2¼ inches width, and 42 inches length and 2¼ inches width. The rear springs in the same order are 64 inches length and four inches width, 62 inches length and 3½ inches width, 56 inches length and three inches width, 50 inches length and 2½ inches width, and 50 inches length and 2½ inches width.

The forward axles are nickel steel drop forgings that are equipped with roller bearings for the wheel spindles and the steering knuckles. The wheelbases of the trucks are respectively 168, 158, 156, 130 and 118 inches. The wheels are artilery type, of wood, and the tire sizes of the trucks in order of size are: 5-6-ton, 36 by six-inch single front and 40 by six-inch dual rear; 3½-ton, 36 by five-inch single front and 40 by five-inch dual rear; 2½-ton, 36 by four-inch single front and 36 by four-inch dual rear; 1½-ton, 34 by 3½-inch single front and 36 by five-inch single rear; one-ton, 34 by three-inch single front and 34 by four-inch single rear. One will note that these tires are ample in size to obtain satisfactory mileage and that they are over-size when compared with the standard equip-

Interior of the Patented Transmission Gearset, the Interlock and the Control Levers of B. A. Gramm's Trucks.

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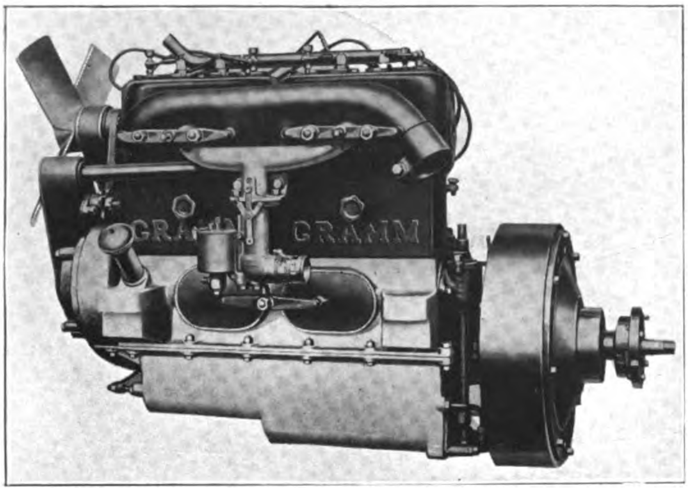


Left Side of Waukesha Engine, Showing the Governor Operated from the Timing Gearset.

ment of the majority of motor vehicles.

The steering gears are Ross specially built worm and nut truck types, with very large hand wheels. The gears are irreversible and driving is comparatively easy with them, for the front wheel pivots are mounted on roller bearings, the linkage is carefully proportioned and the leverage large. The steering columns are located at the left side and the control is by the usual clutch and service brake foot pedals, the central hand levers for shifting the speed ratio gears and the emergency brakes and with hand levers on top of the wheel regulating the fuel supply and the ignition.

Brakes of Large Surface Area.

The brakes are maintained to be unusually efficient. These are internal expanding types, both the service and the emergency sets operating within large steel drums on the rear wheels. These brakes may be regarded as extremely liberal in proportions, those of the 5-6-ton truck having 452.4 square inches area for each set, of the 3½-ton truck 310.2 square inches, of the 2½-ton truck 300.2 square inches, of the 1½-ton truck 296.9 square inches, and of the one-ton truck 176 square inches. These brakes are easily adjustable and with them there is certainty of control no matter what the conditions. Large grease cups and oilers insure adequate lubrication throughout the chassis.

The weights of the chassis in order of sizes are 8000, 7000, 5500, 4000 and 3600 pounds. The machines are governed to standards determined at the factory, the regulation being by positive automatic governors that cannot be changed without the owners' knowledge. The standard maximums recommended are, in order of size, 11, 13, 15, 18 and 20 miles an hour. The chassis are equipped with seats, front fenders, oil dash and tail lamps, hub odometers, jacks, horns and kits of tools, and they are sold f. o. b. Lima, O., painted to order only, for $4300, $3400, $2600, $1800 and $1500.

These machines may be equipped with electric generator, large battery and electric lights, for $100 extra for any model, and with such a lighting system and an electric engine starter for $200 extra.

20,000 TIRES DAILY FOR GOODYEAR.

With six new additions to the plant of the Goodyear Tire and Rubber Company at Akron, O., which will be in operation by the first of the year, the Goodyear Tire and Rubber Company can produce 20,000 tires a day and continue the company in the position of the world's largest tire producer. President F. A. Seiberling maintains that there will be very large business the coming year because of the great demand for agricultural products.

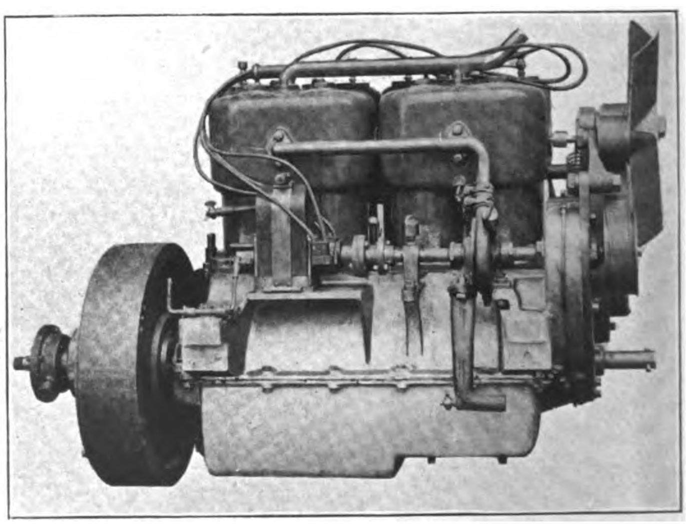
He says that American business is founded on agriculture and when the farmers are well off everybody prospers. The good roads movement will immensely increase the prosperity of the farming districts by reducing transportation costs and, he thinks, be more important to the farmers than to the motor industry, which will, of course, benefit very largely.

SPANG BAKING COMPANY'S SUPPLY TRUCK.

The Spang Baking Company of Cleveland, O., formerly had a number of wagons serving its routes which made only one trip a day. The wagons left the bakery in the morning and by noon were either sold out or the bread was cold and they returned to the plant. The company installed a Little Giant motor truck to replenish the wagon loads. This system keeps the wagons full of fresh, warm bread, so that they can cover much territory that could not be reached before the truck was placed in service.

NEW TRUCK COMPANY AT CADILLAC.

Business men of Cadillac, Mich., who have been successful in other lines are to undertake the manufacture of a motor truck. The company will be known as the Cadillac Auto Truck Company. The president is Walter Kysor, president and general manager of the Cadillac Machine Company; John P. Wilcox, a lumberman, is vice president, and C. J. Helm, manager, is chief owner of the Cadillac Brick Machine Company.



Right Side of Waukesha Engine, Showing the Magneto and Water Pump Installation.

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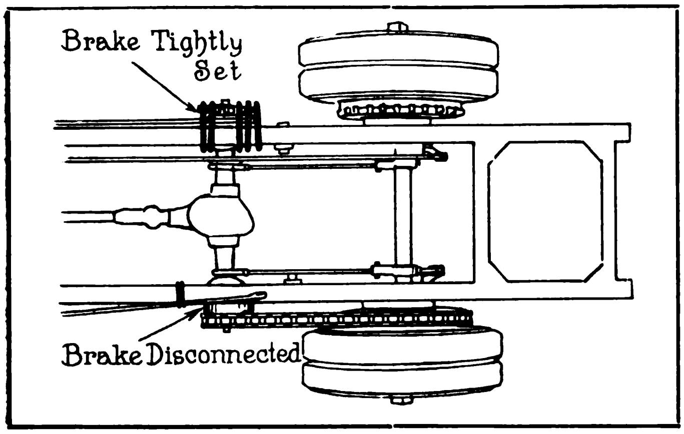
MECHANICAL QUERIES ANSWERED.

Repairing Broken Drive Chain—H. L. G., Waupun, Wis.
Is there a practical way of driving a truck after a driving chain has broken and there are no available materials for making a repair?

If the truck is fully loaded, or the roads to be traversed are hilly, there is doubt that the truck can be driven by its own power without repairing the broken chain. But if the conditions are more favorable the truck can be moved by careful driving with one chain.

By jacking one wheel of any automobile vehicle and placing a gear of the transmission gearset in mesh, the elevated wheel will be turned and the other will not turn. The latter wheel has the least resistance. This is the condition when the chain is broken—one wheel has not the resistance to afford traction.

To drive the truck the wheel that is coupled with the chain must have the least resistance, and this can be obtained by setting the brake on the side on which the chain is broken, and by lashing jackshaft sprocket to the frame with a chain or with heavy wire. When

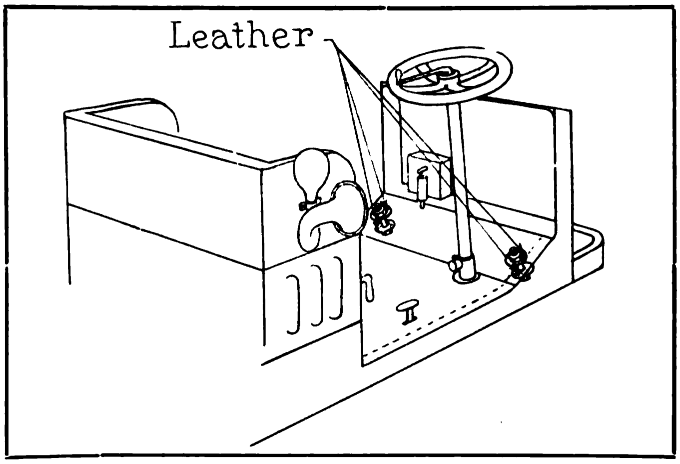


How to Operate a Truck When Drive Chain Is Broken.

the sprocket can no longer be turned idly the other side of the jackshaft and the chain and the wheel coupled to it can be turned with the engine. Obviously the emergency brake on the rear wheels can be used. With this emergency repair the truck can be driven, but as the strain on the lashed sprocket will be very great, driving must be done with extreme care and the machine favored in every way. If the truck is heavy the repair may be impracticable, but if the roads are reasonably level and smooth the vehicle may be moved slowly by its own power.

Silencing Noisy Footboard—R. G. J, Kingston, Mo.
Can the front footboard of a 1914 two-cylinder ——— truck be silenced. It is metal and is at an angle. Lubricating it apparently does not improve the condition.

The noise is evidently caused by the vibration of the contacting metals, which might be reduced by placing a heavy lubricant on them, but this at best would only serve for a very brief period. A much better method is illustrated. The machine to which you refer has a metal floorboard retained by two bolts. By unscrewing the nuts on these bolts the board may be removed. From a piece of soft leather cut four pieces and in the centres cut holes for the stems of the bolts. Place two of these over the bolt ends and then replace the floorboard. When this is done put the two re-

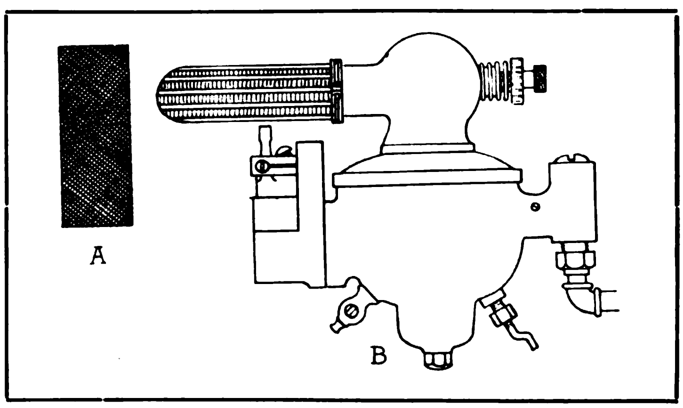


Leather Washers Overcome Noise from Floorboards.

maining leather washers on the bolts and screw down the nuts. This will buffer the floorboard between the two leather washers and so long as the nuts are tight there will be no noise or rattle.

Heating a Carburetor—J. B. L., Norristown, Penn.
I have a truck that has a carburetor fitted to the engine that is not provided with means for heating. Last winter I had difficulty starting the engine when the temperature was low. I was advised that the condition could be much improved if the carburetor was heated. I have studied attaching a tube from the exhaust manifold, but this does not appear practical. I do not want to buy a new carburetor and would like to obtain a suggestion by which the carburetor I have can be heated.

A metal band might be placed about the cylinder unit and the tubing extended from this to the carburetor. If this is not practical, or a connection cannot be made with any heated part of the engine, a strip of cardboard, leather or metal placed at the base of the radiator would divert the flow of cold air upon the carburetor. Such a device as is illustrated at A might be extremely serviceable. This is a cage of wire screen to which a part of an ordinary cotton stocking has been sewn. Any other similar material can be used.



Practical Provision for Heating the Carburetor in Cold Weather.

This can then be clamped to the auxiliary air port, as is shown at B. As the material is porous the air can be drawn through it.

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WISCONSIN MOTOR RECORDS.

Quality and Endurance of These Engines Established by Stutz Racing Cars.

The wonderfully consistent winning of the greatest racing events of the year by Stutz cars, which was climaxed by taking first and second places in the Astor Cup race at a speed of 102.60 miles an hour, has established the Wisconsin engines, used in these machines, as not only the best in America, but the best in the world. And in this connection statement should be made that the Wisconsin engines built for truck service are equally as well designed and as enduring.

The racing engines are to a new design used for the first time at Indianapolis this year, in which event all three cars of the Stutz team finished and a Stutz car was the first American machine to finish. These cars won first and second places in both the 300-mile races of the Chicago Automobile Club at Elgin, Ill. They took first and second places in the 500-mile speedway contest at Minneapolis, Minn., and they won the 300-mile race at the Des Moines, Ia., speedway and made 101.4 miles an hour at the Chicago 100-mile invitation race.

In the Astor Cup contest they wore down the Peugeot and Delage cars, the best racing machines of European engineers, and fittingly closed the most brilliant racing season ever known for a single make of car. The endurance of engines was marvelous, considering the use, and the consistent winning was a triumph for engine design and lubrication.

Of the Indianapolis race the Autocar, one of the leading automobile journals of England, made the following statement:

> No doubt the best performance of the race was that of the Stutz team, as all three finished in good positions and none of the three made even so much mechanical adjustment as to change a plug. The engines in these cars, made by the Wisconsin Motor Manufacturing Company, are the first modern type ever turned out by an American firm; they are the first 16-valve engines which America has ever put in a race. The writer believes, speaking from memory, it is the first time in history that a team of three cars of completely new design have ever all finished a race, so the makers are very greatly to be congratulated. It is the commencement of a new era in American racing, just as the Peugeot successes three years ago began a new epoch in European contests. The extended and invigorated standard car is no longer any use in U. S. A. for real racing.

Claim is made for the Wisconsin motor that it is entitled to the title of champion American speedway motor, and as it now holds the world's speedway record, this claim might justly be made for the world's title. Claim is also made to the title of road race champion motor from the fact that it has won in the past four years more contests than have been won with any other engine in 10 years.

A Wisconsin motor was in the Stutz car that Barney Oldfield drove and won the Los Angeles-Phoenix desert race of 696 miles in 23 hours last year; another Wisconsin motor was in the Stutz car driven by E. G. Baker in which he broke the coast-to-coast record by four days, two hours and 45 minutes, when he drove from Los Angeles, Cal., to New York City, 3728.4 miles, in 11 days, seven hours and 15 minutes. A remarkable fuel economy record was made during this drive, for 352 gallons of gasoline was used in this engine, having bore of 4¾ inches and stroke of 5½ inches, this being a consumption of 10.6 miles to the gallon. The engine consumed 8½ gallons of oil, or 440 miles to the gallon. In the official test by the Automobile Club of America after the drive an average fuel consumption of 0.65 pounds to the gallon by the engine was shown.

STANDARD WOVEN FABRIC'S NEW PLANT.

The factory of the Walpole Tire and Rubber Company at Walpole, Mass., has been purchased by the Standard Woven Fabric Company of Framingham, Mass., maker of Multibestos brake linings and clutch facings. The factory will be used as a spinning department for making asbestos yarn, so the company can control all the processes in its business from the asbestos mines to the automobile, and to afford manufacturing facilities for the company's growing mechanical rubber goods department.

The Standard Woven Fabric Company has grown very rapidly since its incorporation in 1911. For two years it operated a rented shop in Worcester, and in 1913 moved into the factory in Framingham, which was then amply large. The plant has been running 23 hours a day for some time.

A. H. Burdick, treasurer and general manager, came to the company from the General Electric Company, where he was head of the purchasing department. F. J. Gleason, formerly of Walpole, will be in direct charge of the Walpole plant. He was one of the founders and for years was general superintendent of the Massachusetts Chemical Company, and is an expert in mechanical rubber goods production. George D. Moore of Worcester is president, Stoughton Bell of Boston is vice president, Thomas J. Daly of Worcester is secretary, and R. D. Northrup of Framingham is assistant treasurer.

WARD ELECTRIC DRIVEN 733 MILES.

The longest cross-country trip ever made by an electric wagon was with a Ward machine, which left New York, Oct. 6, at the time of the opening of the Electrical Exposition and Motor show, and was driven to Cleveland, O., 733 miles, in 11 days.

During the drive daily bulletins were sent to the electrical exposition, giving the mileage made each day, and the night the exposition closed it was announced that the wagon would be in Cleveland the next morning. The running speed averaged 8½ miles an hour and 84 hours and 43 minutes were spent on the road. Only 25 charges of the battery were necessary. The car was on exposition during the convention of the Electric Vehicle Association of America at Cleveland.

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ELECTRIC VEHICLE PRACTISE.

Operating Edison Alkaline-Nickel-Iron Cells, the Charging Voltage and Amperage for Differing Batteries, for Boosting, and the Normal Discharge Rates—Some of the Characteristics That Indicate Conditions of Charge.

By William W. Scott.

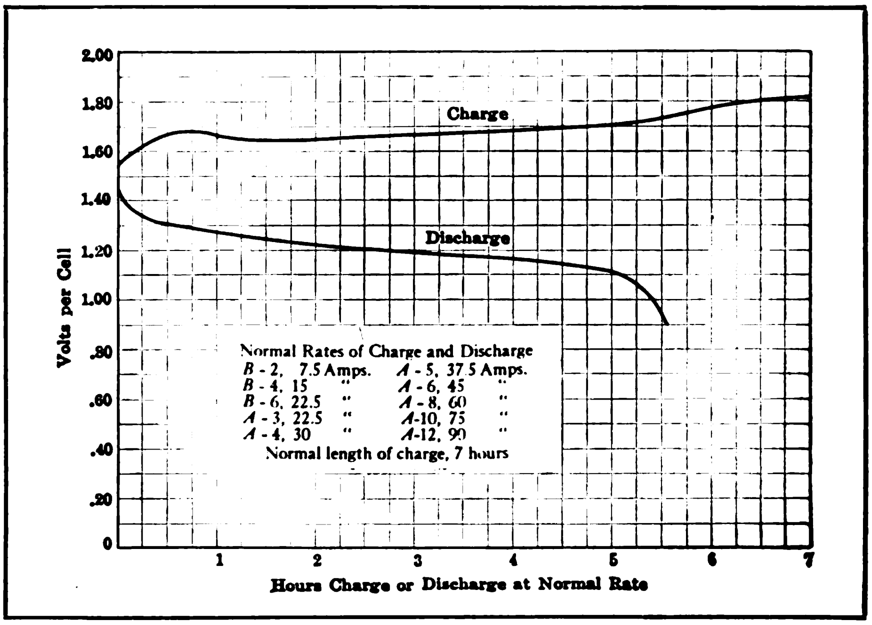
CHARGING Edison cells in a general way is in accordance with the principles stated with reference to lead-acid cell charging, but there are conditions that will be at variance with the recognized practise with the latter type. Only direct current can be used, for the voltage must be impressed. The voltage of the current and the amperage will depend upon the number and size of the cells in the battery.

The charging equipment necessary for Edison cells may be any of the types that has been specified as required for lead-acid cells—that is, a direct current generator, a charging set consisting of an alternating current motor and a direct current generator in combination, a rotary converter, a mercury arc rectifier, a mechanical rectifier, or whatever may be recommended for the service.

With the charging apparatus must be provided the charging panel or switchboard with a rheostat to obtain the necessary resistance, switches, voltmeter, ammeter and circuit breaker and fuses. There are no limitations for the use of these as compared with their uses with lead-acid cells, but, of course, no determinations can be made with specific gravity readings, for these will not indicate the voltage of the charge.

Edison cells differ with lead-acid cells in that the normal charge, from the lowest permissible discharge to maximum, is made in seven hours, and the normal discharge is made in the same period. By normal charge or normal discharge period is meant that in which the greatest economy of charging current and discharging current can be obtained, for there is no reason to unnecessarily supply current, and when the battery has been charged there is every reason to desire obtaining the greatest efficiency from it.

One will note after reference to the accompanying tabulation of charging rates that the required voltage



Curve Showing the Characteristic Sharp Rise Early in Charging, and the Decline and Gradual Increase of Voltage and the Uniformity of Discharge.

can be obtained by multiplying the number of cells by the constant 1.85 (this representing the maximum voltage), so that there need never be uncertainty as to the current value that ought to be used. But the figures in this table represent the lowest voltage that can be used for efficient charging, and unless they are

DISCHARGE DATA, APPLYING TO INDIVIDUAL CELLS.

Type of Cell	B2	B4	B6	A4	A5	A6	A8	A10	A12
Rated capacity, ampere hours	40	80	120	150	187.5	225	300	375	450
Normal actual output (seven-hour charge), ampere hours	42	84	126	168	210	252	336	420	504
Rated capacity, watt hours	48	96	144	180	225	270	360	450	540
Normal actual output (seven-hour charge), watt hours	50.4	101	151	202	252	302	403	504	605
Rated capacity a pound, watt hours	10.4	13	13.7	13.3	13.4	14.1	13.1	13.2	13.2
Normal output a pound (seven-hour charge), watt hours	11	13.6	14.4	15	15.2	15.7	14.7	14.8	14.8
Normal (five-hour) rate of discharge	8	16	24	30	37.5	45	60	75	90
Discharging at normal (five-hour) rate, volts	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Mean effective internal resistance, Ohms	.012	.006	.004	.003	.0025	.002	.0015	.0012	.001
Normal ampere-hour efficiency, per cent.	82	82	82	82	82	82	82	82	82
Normal watt hour efficiency, per cent.	60	60	60	60	60	60	60	60	60

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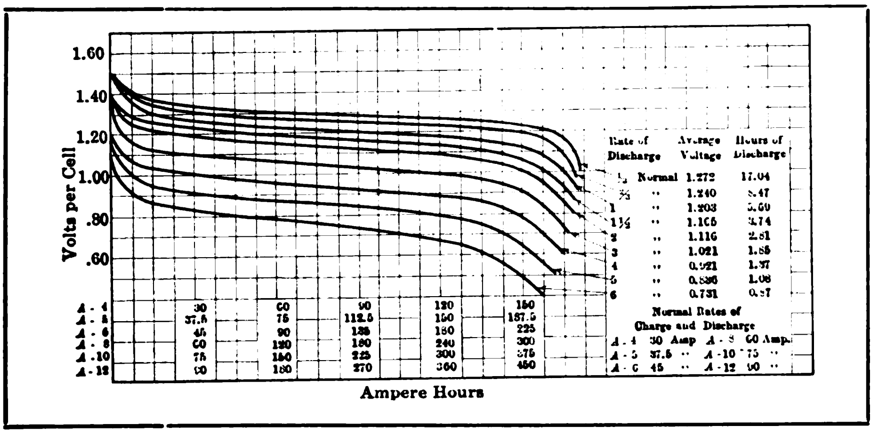
adhered to the batteries cannot be expected to yield satisfaction. This table includes batteries ranging from 10 to 80 cells.

CHARGING VOLTAGES FOR EDISON BATTERIES.

Cells	Volts Across	Cells	Volts Across	Cells	Volts Across	Cells	Volts Across
10	18.5	28	51.8	46	85.1	64	118.4
12	22.2	30	55.5	48	88.8	66	122.1
14	25.9	32	59.2	50	92.5	68	125.8
16	29.6	34	62.9	52	96.2	70	129.5
18	33.3	36	66.6	54	99.9	72	133.2
20	37	38	70.3	56	103.6	74	136.9
22	40.7	40	74	58	107.3	76	140.6
24	44.4	42	77.7	60	111	78	144.3
26	48.1	44	81.4	62	114.7	80	148

These figures do not comprehend "boosting" charges, which are taken up elsewhere in this article.

The reader has learned that there are possibilities with lead-acid cells of the different plates of the cell differing in potency because of local action, and that the condition of each plate can be learned with reference to its activity by cadmium tests, but no tests are possible with Edison cells so far as determining plate condition is concerned. As a matter of fact there is no reason to assume there will be material differ-



Curve Showing the Voltage and Amperage of Cells Discharged from One-Third to Six Times the Normal Rate Subsequent to Normal Charges.

ence in the plates. The design and construction of the cells is such that they are not accessible, and the only possibility provided for is a renewal of the solution from time to time when the reduction of the electrolyte demonstrates that this is necessary to insure a standard of efficiency.

The care of any battery can best be given by formula—that is, by doing the work necessary in a certain manner, so that there is minimized probability of anything being forgotten. For instance, previous to charging the cells should be opened and the height of the electrolyte ascertained, and in the event of any reduction below the level prescribed water should be added. The battery box should then be left open so that it shall be well ventilated, this being desirable to permit the escape of gas created by the charging and to insure against heating, for, as with other cells, the best results are obtained when the lowest degree of heating results from charging.

The standards of temperature are of material importance and these should be thoroughly understood. When the temperature of the electrolyte is less (lower) than 50 degrees Fahrenheit, during either charge or discharge, the efficiency of the battery will be temporarily impaired, but when the temperature is raised the battery will have its normal capacity on subsequent charges. The best results can be obtained when the temperature of a battery is kept between 75 and 95 Fahrenheit, and this characteristic demands that the battery room be kept reasonably warm in cold weather and as well ventilated as is possible when the weather is warm.

While the battery box or cradle should be open for a full circulation of air when charging, the construction should be such that the compartment can be closed tightly should the weather be cold, so that the heat of the cells may be retained. With a tightly closed compartment the Edison battery can be used in extremely cold weather with quite as good efficiency as when the temperature is high. When charging the temperature of the battery should never be permitted to exceed 105 Fahrenheit, and at no time, except for very short interval, should it exceed 115 degrees while discharging. Emphasis is made that the more consistently a battery is charged and discharged between the prescribed maximum and minimum the longer will it endure and the greater will be the satisfaction obtained.

When a battery is received from the manufacturer the cells are filled with electrolyte and the battery is discharged. It must then be charged, and this can be done with the equipment that has been described. Where the current is direct merely the switchboard and the necessary instruments and rheostat are required, but if alternating the current must be rectified by a motor-generator or mercury rectifier, these being the machines most generally used.

One will note that the charging rate of Edison cells is always given at the seven-hour rate (normal), but two discharge rates are given, five hours and eight hours, and comparison of these two discharge rates will show that the capacity of the cells are practically the same in amperes, no matter which of the two discharge rates is used. For quick reference the following tabulation is given, which shows the normal charging rate and discharge rate at five and eight hours, and average discharge voltage for five and eight hours:

NORMAL CHARGING AND DISCHARGING AMPERAGES.

Type of Cell	Charging Amperage, 7-Hour Rate	Discharge Amperage, 5-Hour Rate	Discharge Amperage, 8-Hour Rate	Average Discharge Voltage, 5-Hour Rate	Average Discharge Voltage, 8-Hour Rate
B1H	3.75	3.75	2.25	1.2	1.24
B2	7.5	7.5	4.75	1.2	1.24
B4	15	15	9.5	1.2	1.24
B6	22.5	22.5	14	1.2	1.24
A3	22.5	22.5	14	1.2	1.24
A4	30	30	18.5	1.2	1.24
A5	37.5	37.5	23.5	1.2	1.24
A6	45	45	28	1.2	1.24
A8	60	60	37.5	1.2	1.24
A8H	60	60	37.5	1.2	1.24
A10	75	75	47	1.2	1.24
A12	90	90	56.5	1.2	1.24

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The tabulation given is based on the normal or rated output of cells, but a characteristic of Edison cells is that they increase in capacity for a period of from one to three months, according to the service and the attention given to charging, so that while the figures stated can always be depended upon, there is every reason to believe that the actual capacity will exceed them from two to 10 per cent. on normal charge, and from 10 to 20 per cent. on overcharge.

Every cell sent out from the factory is guaranteed to have its rated capacity, and the tabulation that has been presented indicates what the probable value of the charges will be. One must understand, however, to obtain these values the prescribed care and attention must be given.

The process of self-forming, or building, of the cells will continue from the time the battery is received until the maximum is reached, and this maximum will not be varied from for a long period. The company guarantees that the rated capacity will be realized for four years, and in many instances this will be considerably exceeded. To obtain this development a series of overcharges must be given, the first at the end of 30 days, and then regularly at intervals of 60 days until the electrolyte is renewed. Then an overcharge is given and the process repeated at the 60-day intervals.

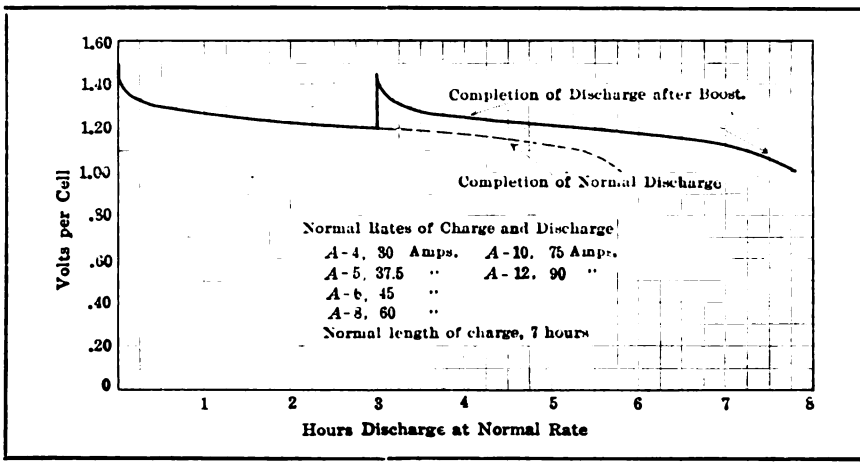
In charging the best results will be obtained with a current supply that will insure a voltage that will slightly exceed the tabulated voltages. That is, while a 110-volt current will charge a 60-cell battery very satisfactorily, which ought to have 111 volts to obtain the full value of 1.85 volts a cell, a current of 115 volts would be better.

When a battery as received from the factory is ready for the first charge it is completely discharged, and it may have been in this condition for several days, or at least during the time necessary for preparation for shipment, while it was in transit and until delivery. To restore it the first charge should be at the normal rate for 12 hours. This long charge is absolutely necessary and should be given for the full period.

After that time the charging should be at the seven-hour rate, and, if wholly discharged, for seven hours. But the period of charging should always be based on the previous discharge. For instance, if a battery of cells rated at 300 amperes has had 100 amperes drawn from it, or approximately a third of its rated amperage, then the charging should be for a third of the full charging period, or two hours and 20 minutes at the normal rate. Wherever the value of the current discharged is known this formula should be followed, but if the value is unknown the charging should be begun at the normal rate and continued until the voltmeter has indicated not less than 1.80 volts a cell for a period of 30 minutes. This will insure a full charge.

When the charging is done with a rheostat the current flow should be adjusted at intervals of 30 minutes so that the current shall remain practically constant. The current may be set a few amperes higher than the tabulated rate, so that there will not be a fall much below the normal rate before the next adjustment is made. In an emergency, where the charging voltage available is such that the normal rate cannot be maintained, the battery may be charged at a lower rate for a longer period of time, but the minimum rate that can be employed throughout a full charge is two-thirds of the normal rate. But low rates of charging are not advised unless there is such a condition as has been stated, and charging at less than normal rate should never be continued.

Where the current cannot be adjusted during the period of charging the rate should be set about 50 per cent. above the normal rate (this being an approximation that will generally be found satisfactory), so that as it is decreased by the rise of the battery voltage it will average about normal. When charging is



Curve Showing the Increased Capacity of a Battery Given a "Boost" of an Hour After Discharge for Three Hours.

done in such circumstances the rheostat should not be adjusted after once set. The charge should be continued the same number of hours as though the rate were constant at the normal rate. When charging is done in this manner the rate will automatically taper until at the end of the charge it will be considerably below the normal.

In the event that an ampere-hour meter is used with the vehicle, or the discharge from the battery can be determined by the ampere and time readings, the charge should be made from 20 to 30 per cent. more than the value discharged, so that the battery may be brought to the highest condition of efficiency. The ampere-hour meter is used precisely as with the lead-acid batteries, and should be set about 25 per cent. slow on charge, which will insure that the necessary full charge is given.

Boosting the battery to restore its capacity within a shorter period than is usually required for charging can be resorted to whenever necessary, and where the work required of the vehicle is in excess of its ordinary mileage rating this can be done during periods of

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idleness. In average conditions the following boosting rates may be used, but the actual rates that can best be used can be determined by two factors—the

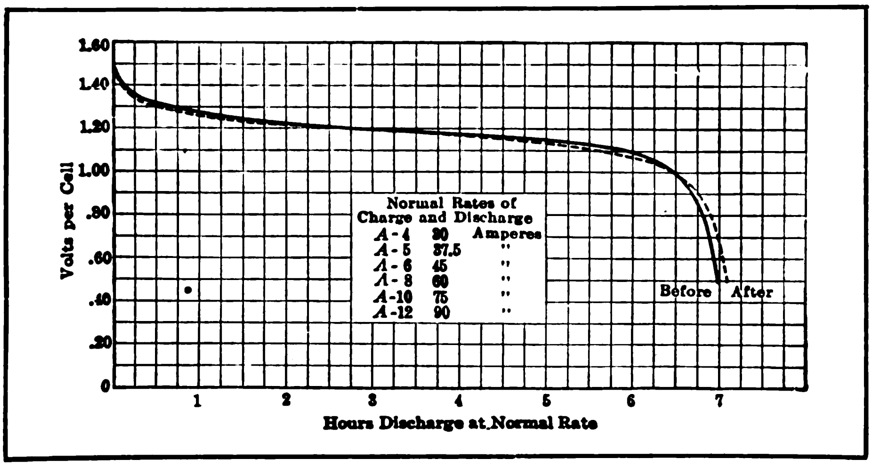
AMPERAGE FOR BOOSTING CHARGES.

Type of cell	5 minutes	15 minutes	30 minutes	60 minutes
B1H	18.75	15	11.25	7.5
B2	37.5	30	22.5	15
B4	75	60	45	30
B6	112.5	90	67.5	45
A3	112.5	90	67.5	45
A4	150	120	90	60
A5	187.5	150	112.5	75
A6	225	180	135	90
A8	300	240	180	120
A10	275	300	225	150
A12	450	360	270	180

temperature of the cells and the gassing.

With experience the current values that will cause heating and gassing will be accurately known, and these can be taken as the basis for charging, for an arbitrary value may not be always advisable to accept. The boosting charges may be:

This is on a basis of five times the normal rate of charging for a period of five minutes, four times the rate for 15 minutes, three times the rate for 30 minutes and twice the rate for 60 minutes.



Curve Showing the Capacity of a Cell Given Normal Rate Overcharges Before and After Standing Wholly Discharged for Six Months.

The temperature of the battery should be observed during boosting charges, and preferable those near the centre of the battery should be examined for heating. The temperature should not ever be above 115 Fahrenheit. The formation of froth on the electrolyte is another indication of excessive charging (this resulting from heat and gassing), and in the event of heating or frothing (provided that the electrolyte is at the standard height), the current should be reduced in amperage or discontinued.

Should occasion require immediate use of a battery charging can be terminated and the battery placed in service with whatever current it may contain, and after use it may be charged in the usual manner.

The charging should never be less than the normal rate save toward the end of a charge that will automatically taper. Low rate charging does not affect the battery permanently, but it does reduce the speed and the mileage for several discharges immediately following the low rate charging.

The charge of Edison cells is illustrated by an accompanying curve chart that shows that there is a rapid rise of voltage during the first 45 minutes of charging, after which there is a slight fall and then a very gradual increase until the expiration of the seventh hour, when the voltage will remain constant. Careful observation of the voltage readings will give very accurate indication of the condition of charging, but this must be gained by experience, and no definite rule can be established. Neither can an absolute figure be given for full charge voltage, as this will depend upon battery temperature, condition of the electrolyte, and perhaps other conditions. When the voltage across the battery terminals at the end of the charging period, under normal conditions, average from 1.80 to 1.85 a cell at normal current rate the battery may be regarded as charged fully.

Examination of the chart will indicate the quick rise in voltage very early in the charge, a condition that might be accentuated by differing causes, from which one unfamiliar with this characteristic would undoubtedly assume that a full charge had been reached. When this abnormal voltage rise is noted it will be always during the first part of the charge and will be followed by a fall to normal value, so that one can be certain of recognizing this indication and understanding it.

No deteriorating effects follows overcharging, but the volume of water dissipated is greater, necessitating more frequent filling of cells, the current used is wasted, and there is excessive heating. For these reasons the overcharges should only be made at the intervals advised, or when there should be occasion to require an unusual period of discharge.

With reference to the periodic overcharging, the preparation should be the complete discharge of the battery and the solution should be brought to the level specified, tests of the electrolyte being made before and after the overcharge.

In the event that a battery appears sluggish in action, the more use that can be made of it the better, for with successive complete charges and discharges it will regain its full capacity. But continued lessening of the capacity is usually an indication that the solution should be changed.

The normal discharge rates are, as has been stated, the same as the normal charging rates, and the average discharge voltage of any cell, when worked normally, is 1.2 volts a cell for five-hour rate and 1.24 volts a cell for eight-hour rate, and the discharge is practically completed when an average voltage of one volt a cell is reached. The characteristic of the discharge is shown by an accompanying chart, there being a sharp initial drop, and then a gradual fall until near the end of the discharge period, when there is another quick

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decline. This represents normal discharge.

A battery can be discharged continuously up to a rate 25 per cent. more than normal, but this should not be practised, because of the heating and the loss of voltage. For short periods of time, as when climbing hills and starting heavy loads, the rate may be increased beyond the limitation practically to any value desired, but maximum power is developed when the discharge is about six times normal, and if this rate is exceeded the power will diminish instead of increasing.

An accompanying chart shows by curves the discharge of cells at rates ranging from one-third normal to six times normal subsequent to normal charges, the exact time of discharge by hours, and the average voltage, as well as the normal rates of charge and discharge. This is indicated by ampere hours, there being a decided loss in voltage and but little lessening of amperage as the discharge rates are increased.

The practical results from boosting charges are also shown by a curve, the "boost" being given at the expiration of three hours' discharge, this indicating by voltage and ampere hours the decided increase in capacity, and adding two hours' service to the battery. This curve illustrates the discharge obtained in one day by supplementing the normal charge with a double rate "boost" during the noon hour. The discharge was at normal rate and showed 1.16 plus rating at 83 per cent. current efficiency. The actual output on normal charge plus the one hour "boost" was 1.56 plus, at 86.7 per cent. current efficiency.

As Edison cells can be discharged and kept in that condition when necessary, the capacity of the cells after such periods of idleness are specially interesting. A chart of a curve included shows the efficiency of a cell which had stood completely discharged for six months. The runs plotted on the curve were made immediately before and after the period of inactivity, in both instances the cells being given normal rate overcharges. One will note from this curve that there was practically no change in the capacity of the cell with reference to voltage or amperage.

(To Be Continued.)

The J. C. Tucker Company, which sold trucks and passenger cars in Boston and Providence, has abandoned the sale of passenger cars and is now devoting itself exclusively to marketing trucks.

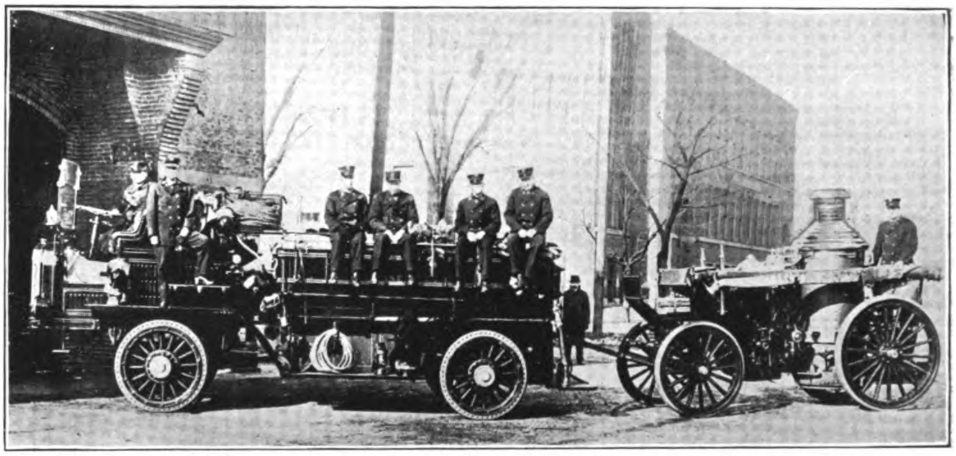
A spring starter, invented by G. L. Rock, will be made in Jonesville, Mich., where a building formerly used for assembling motor cars will be used.

TRUCK HAULS FIRE PUMP.

Combination Chemical Apparatus Serves as Tractor in Minneapolis.

In the fire department service of the city of Minneapolis, Minn., is a Four Wheel Drive five-ton truck, equipped as a combination hose and chemical apparatus, which in addition to hauling its own load to a fire, also serves as a tractor for a steam pumping engine. This is perhaps the only truck that has been adapted in this manner and its successful operation is a sufficient demonstration of the power and capacity for traction which is a pronounced quality of the Four Wheel Drive type of construction. The truck is built by the Four Wheel Drive Motor Company of Clintonville, Wis.

The chassis is standard in every way. In addition to the heavy body, a large chemical tank, hose and ladders, it carries regularly a crew of 11 men. The steam fire engine that is drawn weighs fully five tons.



Four-Wheel Drive Combination Fire Apparatus Truck Used as Tractor for Steam Pumping Engine at Minneapolis, Minn.

On April 27, 1915, this powerful truck made a run from station No. 5 in Minneapolis to headquarters in St. Paul. The distance was eight miles and a half and the time required for the run was 18 minutes—a speed of slightly less than 30 miles an hour.

It has shown all the speed that safely can be used with any type of apparatus and has the power to take its heavy load at good speed up any hills in Minneapolis. The movement of so much equipment with a single motor is naturally a source of great economy for the fire department.

The Auto Wheel Company of Lansing, Mich., is working to capacity and has orders on hand for a year ahead. The plant has been considerably enlarged since last year.

The new French tariff of 45 per cent. on all American cars sold in the French possessions affects trucks as well as passenger cars. In the case of the English act commercial vehicles are especially exempted.

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CO-OPERATE TO SELL TRUCKS.

Electrical Interests in Metropolis Engage in Three-Cornered Sales Campaign.

A three-cornered campaign to place electric delivery vehicles in the hands of business men in New York City and New York and New Jersey, contiguous to the Metropolis, has been undertaken by the Edison Storage Battery Company, the electrical lighting companies of that section and the Ward Motor Vehicle Company.

The Edison Storage Battery Company is to rent its batteries, keep them charged and care for them fully for a stated monthly rental. The Ward company will sell its 750-pound delivery wagon on easy monthly payments at $875, which includes a year's rental of battery and battery service for that time.

Thus the first cost of the equipment is made low compared to what it formerly was, and with expert service assured there will be little reluctance on the part of prospective buyers to try something new. It will be possible under the circumstances to operate the small electrics with the same delivery men who have been employed on horse wagons.

Garages at which the service will be supplied have been established in all parts of the metropolitan district. Electricity is one of the few commodities which has consistently fallen in price during the past decade, according to Mr. Edison, and with the new plan the merchant can take advantage of this cheap electricity to improve his delivery service and increase its radius at a smaller cost than with horses.

This plan was explained recently to the engineers of the electric lighting companies in the district who visited the Edison factory in Orange and they promised hearty co-operation with the plan.

They were shown in details the operations by which Edison storage batteries are made. The meeting inaugurates something entirely new in electrical vehicle salesmanship in the metropolitan territory, and is likely to have a far reaching effect on the industry.

In the group shown in the accompanying photograph are: Harvey Robinson, manager of the Automobile Bureau of the New York Edison Company; Stephen G. Thompson, Public Service Electric Company, Newark, N. J.; B. Irwin, Brooklyn Edison Company; D. F. Tobias, United Electric Light and Power Company; Charles A. Barton, New York and Queens Electric Light and Power Company; Charles A. Ward, secretary and treasurer of the Ward Motor Vehicle Company; J. C. Boyers, sales manager of the Ward Motor Vehicle Company; Thomas A. Edison, president of the Edison Storage Battery Company; H. G. Thompson, vice president and general sales manager, and E. J. Ross, Jr., manager of the sales engineering department of that company.

Thomas A. Edison, His Representatives and a Group of Electric Lighting and Vehicle Men During a Conference at Orange, N. J.

NINETY-THREE ACCESSORY EXHIBITS.

Space at the New York and Chicago shows has been allotted to 93 makers of accessories by the Motor and Accessory Manufacturers at the meeting of the association in New York, Oct. 8. Both the number of exhibitors and the amount of space assigned were greater than for any previous show.

At the same meeting the board of directors of the association voted to admit the following firms to membership: Brunner Manufacturing Company, makers of air compressors, Utica, N. Y.; E. A. Laboratories, Inc., manufacturer of automobile electric and hand horns, Brooklyn, N. Y., and the Leece-Neville Company, manufacturer of electric starting and lighting systems, Cleveland, O.

TAKES INTERNAL GEAR DRIVE AXLES.

The British war department is said by the Internal Gear Drive Association to have followed the French and German governments in showing a decided preference for internal gear drive axles on motor trucks. A few weeks ago a British manufacturer announced for the market a 3½-ton truck with an internal gear drive axle.

Immediately the British war department contracted for the available supply of this type of truck. At the same time it released for delivery to British buyers a number of trucks equipped with another form of final drive and of the same carrying capacity.

The French and German armies showed great partiality for the internal gear drive before the war and had many of them in service or available when the struggle began.

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PRACTICAL MOTOR TRUCK MECHANICS.

Several methods are extensively used for straightening bent frames, but the best results can be obtained by gradually bending the metal back to shape, rather than striking it with the hammer. Apply a blow torch to the point of bend until the metal becomes red hot. Now adjust a large wrench to the end of the frame, as shown in Fig. 40 A, and straighten by a steady pressure. If it is now found that the part is not absolutely parallel with the corresponding part, it may be trued by applying the wrench as shown in Fig. B.

HOME-MADE ENGINE OIL GAUGE.

Engines of earlier design are not always equipped with indicators or gauges to show the quantity of oil in the crank case or reservoirs. An easily constructed indicator is shown in Fig. 41. Usually the case will have a petcock at the base for draining it and this should be removed and a T fitted in the opening as at

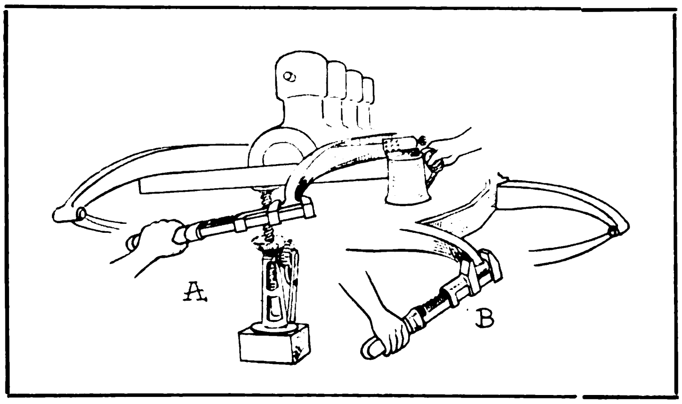

Fig. 40—A, Straightening a Bent Frame After Heating; B, Truing with a Wrench.

E. Screw a short pipe into the T as at F and at the free end fit an elbow, G. A small glass gauge, H, can be obtained at any hardware store and this should be attached to the elbow by a short pipe, I. The length of the pipe can only be determined by experiment.

A short piece should be tried at first and oil placed into the crank case until the engine emits a smoky exhaust. The oil should then be gradually drained until the smoking ceases. This is the correct oil level. A pipe should now be fitted that is of the proper length to allow the oil to appear about an inch from the top of the gauge. This point can be marked on the gauge and the driver can always determine the quantity of lubricant that is in the crank case. A petcock can be fitted to the free end of the T for draining purposes.

REAR AXLE HOUSING PRESSURE RELEASE.

When the felt packing washers or gaskets are worn grease will work out of axle housings and on to the rear wheels. But grease on the wheels is not always a result of the wear or hardening of the felt washers. Experiments have proven that expansion of air in the differential housing may cause sufficient pressure to force lubricant past the washers. Such leakage can be

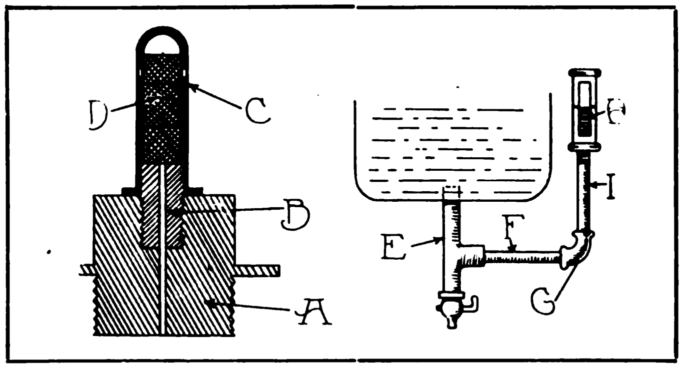

Fig. 41—A, Device for Reducing Pressure in Differential Housing; E, Oil Gauge for Old Type Motor Crankcases.

stopped by attaching a vent to the filler cap, as shown in Fig. 41 A. This is only advisable when the cap is located on one side of the housing and not in the centre, directly over the ring gear. Obtain an old valve stem, as shown at B, and cut off a piece of about one inch in length. Next drill and tap the cap so as to admit the stem. It is advisable to lightly solder the stem to the cap so that it cannot work loose and fall into the housing. Obtain an ordinary dust cap and drill three small holes at the top as at C and then insert a fine brass screen, as shown at D, and screw the cap tightly on the valve stem. The screen will prevent dirt or foreign matter entering the housing, but does permit equalization of the air pressure.

PRACTICAL PRIMING DEVICE.

In cold weather starting can be made easier by priming the motor. This is inconvenient for the driver when it necessitates raising the hood. An easily made priming device which will better convenience the driver is shown at Fig. 42. Run a length of annealed copper tubing from the top of the intake manifold to

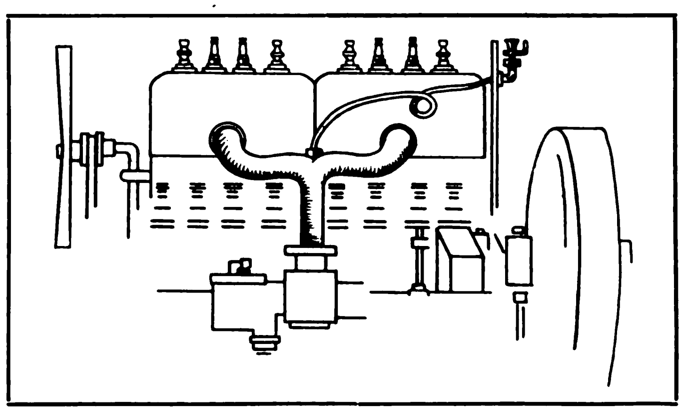

Fig. 42—Method of Priming an Engine from the Dash.

the dash. The manifold should be drilled and tapped and a connector fitted as shown. A small coil is then made in the tubing so as to prevent breakage from vi-

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bration and the free end carried through the dash. An elbow and priming cock is then fitted as shown. Of course the priming cock on the dash should be higher

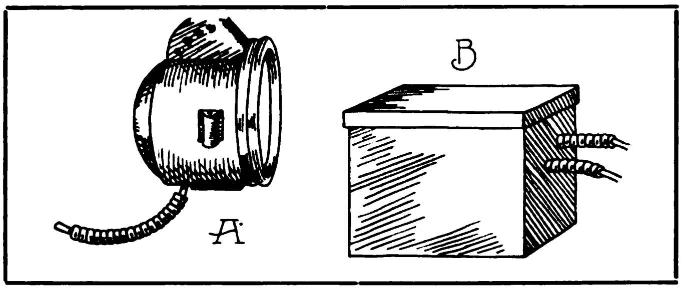

Fig. 43—A, Protecting Rubber Pipe with Flexible Metal Tube; B, Armoring Electric Cable at Battery Box.

than the end of the tubing which enters the manifold, as the flow from the tank is by gravity. The device is especially useful, as the cup may be slightly opened to admit auxiliary air to the mixture. Water can also be fed to the motor in this manner for removing the carbon from the cylinders.

ECONOMY OF FLEXIBLE TUBING.

All the accessories of the truck that are subject to wear can be greatly reduced. The life of the wiring, gas tubing, etc., can be increased at slight expense and little trouble. Metallic flexible tubing is now marketed in various sizes and is inexpensive. If a small piece of this was placed over the rubber tubing leading to the gas lights, as shown in Fig. 43 A, the rubber would not be subject to the weather and could not kink, a trouble frequently met with. At Fig. 43 B is shown a method of preserving the insulation on the wires leading from the battery. Pieces of tubing are inserted in holes in the battery box and the wires passed through them.

LIGHTING THE WASHSTAND.

Lights of the overhead type for garage washstand are not always satisfactory, for they do not illuminate the wheels and sides of the machine. At Fig. 44 A is shown a simple home-made lighting stand. Secure a length of piping to a wood base and then drill and tap a hole near the top for a small thumb screw. Select a rod which corresponds in diameter to the hole in the pipe. Insert as shown. Now obtain a reflector of sufficient size to project the light of a group of four lamps. Strips of metal should be riveted to the sides of the reflector and holes drilled through the ends and top of the telescoping rod. Attachment can then be made to the stand by a thumb screw and nut. This arrangement will also be found to be useful when making repairs on the machine at night.

PISTON RING COMPRESSOR.

The piston ring compressor shown in Fig. 44 B is easily made and quickly applied. It consists of a suitable length of band iron about ⅛-inch in thickness and ½-inch in width. It should then be placed in a vise and the ends bent as shown. Assuming that the compressor is to be used on a piston 4¼ inches diameter, a piece of metal about 16 inches in length would form the ring. When fully closed the ring should measure slightly less than 4¼ inches diameter, so that when clamped it will firmly hold the piston ring in its channel.

REPAIR OF TIE ROD.

When a machine has been used several years the tie rod between the front wheels will become loose from wear. This play is generally in the threaded parts and operation may be dangerous. A simple repair can be made by drilling through the yoke and rod and inserting a taper pin. This is not permanent, however, as the parts are subject to great strain and the pin will soon wear. If the parts were brazed or welded together the aligning adjustment would be lost. A better repair for this condition is shown in Fig. 44. Remove the rod from the yoke and heat it to a high temperature. A mandrel a trifle larger diameter than the hole should be driven inside, as shown in Fig. 44 C. This will materially expand the metal. Should the outside diameter be too great, the rod can be placed in a lathe and the threads recut. The complete assembly is shown in Fig. 44 D.

COLORING BRASS BLACK.

A well known chemist submits the following as an easy yet effective method of coloring brass articles black. Dissolve blue vitriol in water and then add a quantity of washing soda until a precipitate is formed. The liquid should then be poured off. The precipitate is carbonate of copper. When this substance is mixed with strong ammonia and heated to 150 degrees Fahrenheit, the solution will stain any brass article black. Before emersing in the solution, however, the piece should be thoroughly cleaned, using a potash solution.

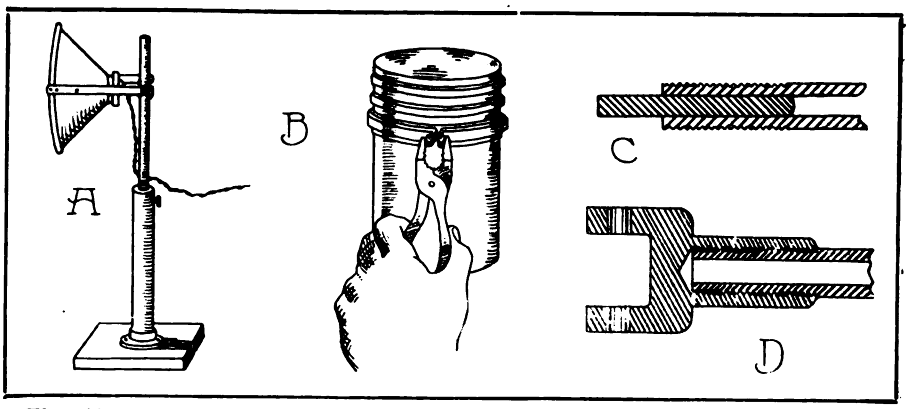

Fig. 44—A, Home-Made Washstand Light; B, Handy Piston Ring Compressor; C, Expanding Tie Rod Tube; D, Repaired Tie Rod.

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CHASE HAS NEW ONE-TON MODEL.

A new one-ton truck model has been added to the line of the Chase Motor Truck Company of Syracuse, N. Y., which is to sell for $1650. It has worm drive and a four-cylinder, L head motor, with bore of 3½ inches and stroke of 5⅛ inches. The wheelbase is 140 inches. Sheldon rear axles, Holley carburetors, Bosch ignition, Brown-Lipe selective sliding gear, three-speed transmission gearset and a pay load on rear axle of 83 per cent. are some of its characteristics. Electric starting and lighting apparatus will be furnished at an extra cost. Deliveries will be begun Dec. 1.

MULTIBESTOS SALES CONVENTION.

At a convention of the sales force of the Standard Woven Fabric Company at the factory at South Framingham, Mass., recently, where a study of the methods of producing Multibestos brake lining and clutch facing was made, statement was made by General Manager A. H. Burdick that at the present rate of growth the business would increase 100 per cent. in the coming year. He maintained that more than 50 per cent. of the brake lining used by American motor vehicle manufacturers is Multibestos.

This was supplemented by Advertising Manager R. D. Northrop, who predicted that with more than 2,000,000 cars in use, and this number increasing by hundreds daily, there would be great increase in the supply trade. Thomas H. Daly, secretary of the company, presided at a dinner at the Framingham Country Club, which was enjoyed by salesmen from the branches in Boston, New York City, Philadelphia and Chicago, as well as those attached to the factory were present.

I. H. C. REDUCES PRICES OF TRUCKS.

Prices have been reduced on the International Harvester Company line of trucks in 1000, 1500 and 2000-pound sizes. Two new six-story additions are being made to the factories at Akron, O., and the trucks will be made in largely increased numbers. The new prices are 1000-pound air cooled, $600; 1000-pound water cooled, $710; 1500-pound, heavy duty motor, $950, and 2000-pound chassis, $1500.

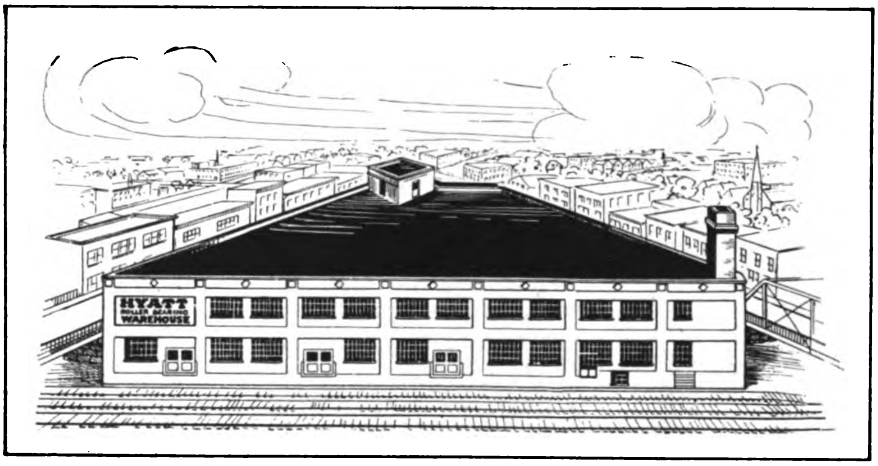
BIG ORDER FOR INTERNATIONAL TRUCKS.

The International Motor Company has closed an order for 700 five-ton trucks for the Russian government. Most of these will be made at the Plainfield, N. J. plant.

HYATT HAS DETROIT WAREHOUSE.

Another step toward making Detroit the distribution centre for its business has been taken by the Hyatt Roller Bearing Company, which has bought land and planned the construction of a shipping warehouse on the Michigan Central railroad in that city. A new building for the sales and engineering departments of the automobile division of the company was recently erected at Cass avenue and West Grand boulevard, in that city.

General Manager A. P. Sloan, Jr., has announced that the new building will be constructed under the direction of Chief Engineer Lane. It will have a frontage of 225 feet on the railroad. It will be of modern concrete construction, two stories high, and will contain 20,000 feet of floor space. The first floor will be on a level with the floors of the freight cars, while the second floor will be at the street level. This will facilitate handling large quantities of freight, which will move in only one direction. That which is to be transhipped to other points will remain on the first floor, while that for Detroit will be taken to the second floor.



Architect's Plan of the Hyatt Roller Bearing Company's Warehouse and Delivery Station to Be Erected in Industrial Centre of Detroit.

At present receipts of Hyatt bearings in Detroit amount to a car load a day. This rate is likely to be maintained throughout the year. Tractor manufacturers will be supplied from Detroit. The building will improve the service of the Hyatt company to manufacturers, as all the sizes in general demand will be kept constantly on hand for quick delivery. H. R. White, who has been connected with the Hyatt automobile division for some time, will have charge of the traffic arrangements.

The International Motor Company, New York, N. Y., has issued a large booklet dealing with the work done with Mack trucks at the recent military encampment of business men at Plattsburg, N. Y. The book contains a detailed account of the work of the truck and numerous letters of commendation from the corporation officials who figured as "Rookies" in the Plattsburg encampment.

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F W D TRUCKS INVADING EAST.

Clintonville, Wis., Company Beginning an Extensive Campaign for Dealers.

The Four-Wheel Drive Auto Company, Clintonville, Wis., which is widely known as the builder of Four-Wheel Drive trucks, and has just completed a very large expansion of its factory facilities, announces in this issue of MOTOR TRUCK the beginning of a campaign that is to be carried on throughout the country to interest progressive business men in the sale of these machines as a commercial proposition.

The statement is made that these machines are the highest priced, are the most expensive to build, and yet the most economical motor vehicles built because from every viewpoint they save money when operating cost is compared with that of other motor trucks.

The Four-Wheel Drive trucks are built in three sizes, 1¼, three and five ton load capacities, and they are driven by all four wheels through full floating front and rear axles. They have the greatest power efficiency, the lowest consumption of fuel and lubricant, the longest endurance and the tire mileage is extremely long.

These are not theories, but are the result of competition in service and in trials with other machines. The company has open territory in some of the best commercial centres, and it is in readiness to make agency propositions to those who are desirous of doing a high-class business, that will constantly increase, and which can be absolutely depended on. Four-Wheel Drive trucks have been built for seven years and are no experiment. The company has the organization and the facilities to afford its representatives and its customers the best of service and close co-operation. This is an exceptional opportunity for those who desire to enter business that is established by public knowledge of truck quality, and which can be developed in ratio to the capacity of the agents.

NEW TIMKEN ADDITION COMPLETED.

The new addition erected at the Clark avenue plant of the Timken-Detroit Axle Company in Detroit, Mich., has four stories and a basement and cost nearly half a million dollars to build and equip. It will be used exclusively as an assembly plant for worm drive truck axles.

The building gives the company 100,000 additional feet of floor space for truck axle construction. The basement is devoted to stock rooms, the first floor to a receiving department and to incoming stock, the second and fourth floors to machining axle parts and the top floor to axle assembly. The increase in business that made the building necessary is largely due to domestic demand, as very few orders have been received that were connected with trucks built for war purposes. Cornelius E. Myers of the Timken-David Brown Company declares that 85 per cent. of the truck axles being made today are of the worm drive type.

Half-Million Dollar Addition to Timken-Detroit Axle Company's Plant, Detroit, Mich., to Assemble Worm Drive Axles.

GOODYEAR USES PLANTATION RUBBER.

According to L. V. Rockhill, manager of the automobile tire department of the Goodyear Tire and Rubber Company, that concern has found the use of plantation rubber much cheaper than wild rubber in the end. The plantation rubber is washed and creped at the plantation so that it comes to the factory clean and dry and ready for use.

The wild rubber must be washed at the factory to eliminate foreign substances by well paid skilled workmen, adding much to the cost of manufacture. It also comes to the factory containing moisture in varying amounts from six to 70 per cent. of its weight. By using plantation rubber this great shrinkage is eliminated and a great deal is saved in freight charges. The Goodyear company now uses more than 10 per cent. of the world's crude rubber production.

Young rubber trees have been planted in great number every year and scientific methods of rearing and tapping have been perfected by which their bearing qualities are sustained year after year. There is to be plenty for all future requirements and probably the price will come down.

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The
MOTOR TRUCK
Devoted to Motor Driven Business Vehicles of All Classes.

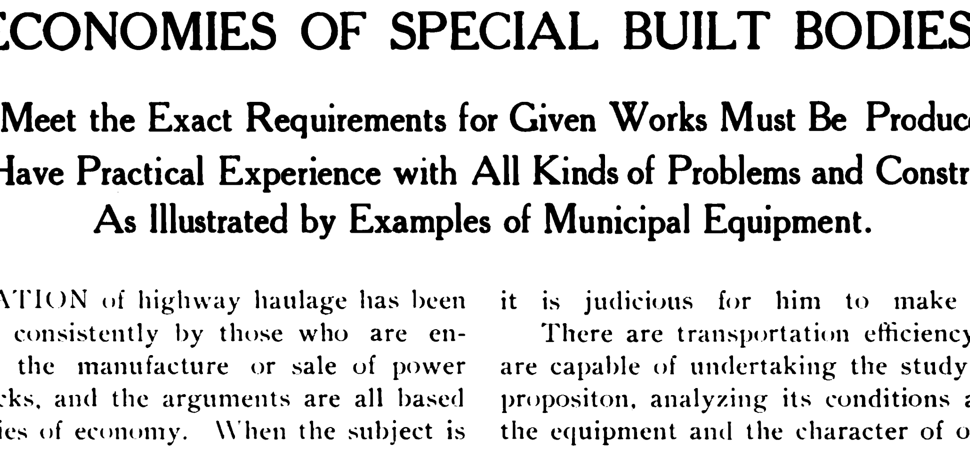
VOL. VI. PAWTUCKET, R. I., NOVEMBER, 1915 No. 11

ECONOMIES OF SPECIAL BUILT BODIES.

Designs That Meet the Exact Requirements for Given Works Must Be Produced By Those Who Have Practical Experience with All Kinds of Problems and Constructions As Illustrated by Examples of Municipal Equipment.

SPECIALIZATION of highway haulage has been advocated consistently by those who are engaged in the manufacture or sale of power wagons and trucks, and the arguments are all based on the possibilities of economy. When the subject is taken up and studied by the individual with the purpose of application to definite operating conditions, one finds that general principles must often be given over and adaptations made to meet requirements that are peculiar to each industry or business.

That is to say, that while a clearly defined object is sought, theory must be abandoned and experiment made that will result in the use of what will afford a satisfactory degree of economy. The greater speed and the larger load capacity of the motor truck can be urged by the salesman as sufficient reasons why such vehicles should be utilized in preference to other types, particularly those drawn by animals, but the average man engaged in selling machines is seldom qualified to advise the prospective purchase the most economical manner of operating them, and he has but little experience with problems of loading and delivery. Superficially, he may have knowledge gained from observation, but his actual experience is not sufficient—at least not what would justify the expenditure of a considerable amount of money, for no business man will consider investment unless he is convinced that it is judicious for him to make it.



A Battery Driven Tractor and Semi-Trailer Designed for the Collection of Refuse and Garbage in the Borough of Richmond, New York City.

There are transportation efficiency engineers who are capable of undertaking the study of any haulage propositon, analyzing its conditions and determining the equipment and the character of organization that could bring about economies, but these men are specialists, whose services can only be obtained by fees proportionate to the work to be done. Obviously the transportation efficiency engineer does not devote his services or his knowledge to the benefit of any particular manufacturer or his selling representatives unless he is associated with him in an advisory capacity, and if he does not give his personal attention to a client he must base his findings or conclusions on the reports made to him.

The salesman, who may have intimate mechanical knowledge of the machines he sells, and general information of some forms of haulage, can undoubtedly establish the fact that economies are possible, but he seldom knows the actual efficiencies of the services on which his judgment and conclusions are based. This is a weakness that cannot only be met through opportunity for determining the relative efficiencies of these services with an actual standard that can be applied, and one must admit that these opportunities are seldom available.

Undoubtedly the salesman is justified in believing that the man who desires to purchase motor vehicles

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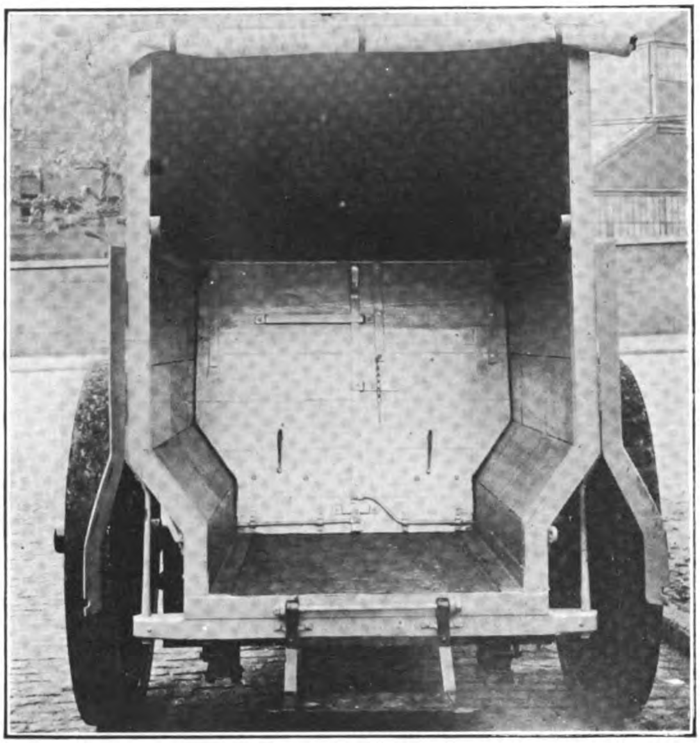


Interior of the Enclosed Body of the Battery Driven Tractor Outfit, Showing the Sliding Tail Gate and the Method of Suspension on Side Rails.

understands the conditions in which they are to be used, and that he has the judgment to work them with system and organization that are efficient. The salesman cannot be expected to supervise a business, or a part of it, simply because his customer wishes advice.

The purchaser of power wagons or trucks may believe that his own judgment is sufficient to meet any operating exigency that may arise, but unless he has had experience in the operation of machines he cannot anticipate conditions that may decidedly influence the efficiency or economy of his equipment. The business man may have his own ideas as to what may be practical, but he is not a specialist in the construction or use of vehicles, and if he is desirous of being certain as to the possibilities he can turn to those who have mature judgment because of experience with problems of this character.

This brings into prominence the services of the men who specialize the construction of vehicle bodies, who have been forced to study and devise means for practically operating wagons and trucks to save time and labor, and who have had ample opportunity for developing equipment that is enduring and economical.

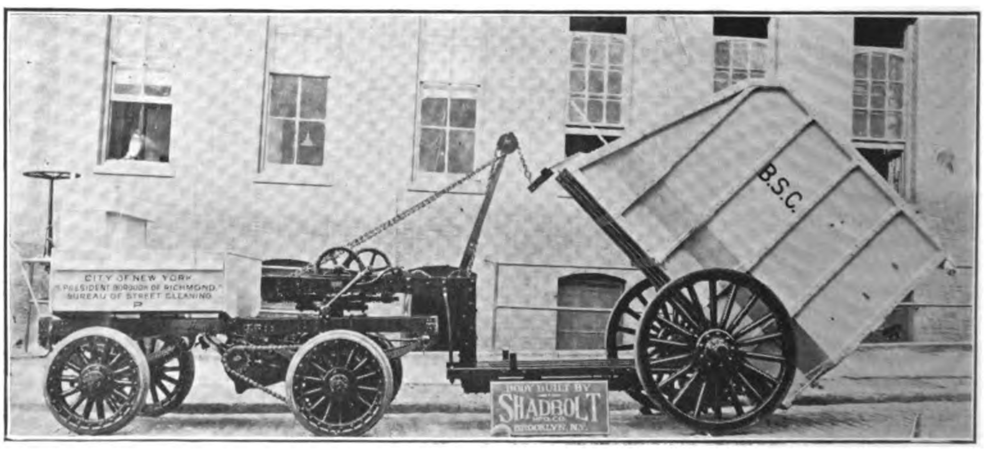
In the motor vehicle industry there is no stronger influence for progressive development than the designer and builder of bodies, who knows the possibilities of constructions, who can adapt ideas practically, and who can work out problems so as to obtain at least economic service. The first years of the industry were given over to obtaining experience, both in machine and body construction, and the men who had been successful in developing special animal conveyances were very generally believed to be inexperienced with automobile vehicles.

Those who first purchased power wagons and trucks generally believed that they could adapt faster and larger capacity vehicles without reference to other conditions, but a very usual experience was that despite these qualities the economies anticipated were not realized, simply from the fact that the operating conditions were unchanged, and the idle time of the machines and the men was practically the same as with animal vehicles. Then there was a demand for equipment that could be quickly loaded and unloaded, and after experience with vehicle so equipped owners found that the best results were obtained from bodies that were specially adapted for the particular conditions in which they were to be used.

Uncertainty an Obstacle to Progress.

Theoretically, the largest economy would result from the construction of loading or shipping facilities that were designed with particular reference to the needs of each business enterprise, but in most instances these changes would necessitate large investment. The possibilities for economies were often regarded as uncertain by business men, for study of any condition is certain to develop problems that are complex and present almost endless ramifications, and men of large resources who would not hesitate to meet a positively determined condition, hesitate when dealing with what may be judged to be more or less experimental.

Not only this, there is no reason to expect that unloading or delivery conditions can be controlled, and often what may be regarded as a temporay plan, with no intention of it being permanent, is adopted, possibly with the hope that concerted action may be brought about later on. The value of common forms of quick discharging bodies are generally well understood, but the uses that can be made of these are limited so far



The Semi-Trailer Body Elevated to Its Full Height for Dumping, the Hoist Being Driven by a Motor Supplied with Current from the battery of the Tractor.

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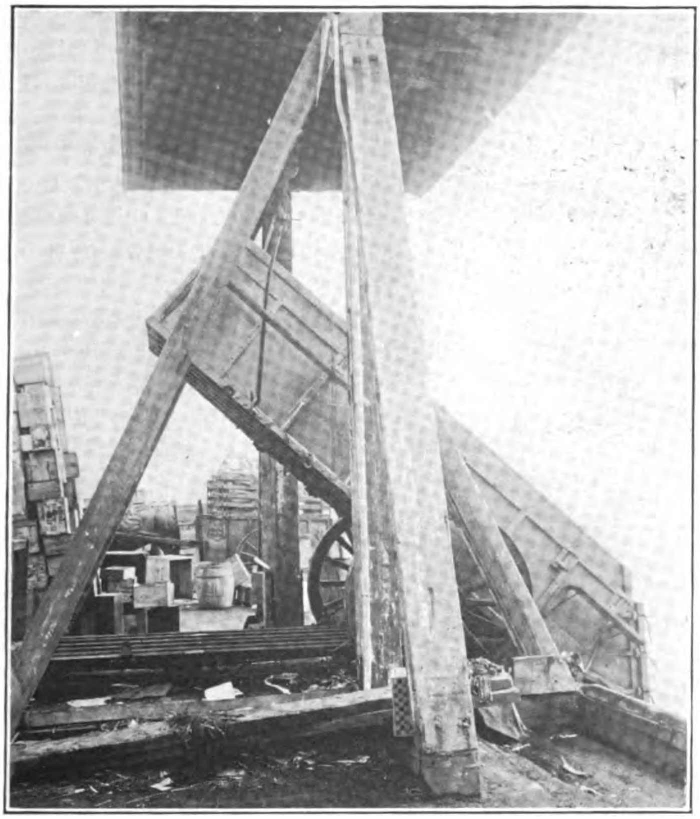

The Body of a Large Capacity Semi-Trailer Built for Garbage Collection in New York City Elevated by a Permanent Hoist at the Dock to Deposit the Load in a Scow.

as efficiency are concerned, and as a rule these are utilized only with bulk freightage.

Special Body Equipment Necessary.

Those who have studied the general subject of transportation have learned that there is just as much economy in the design or body equipment as there is in special machine or hand tools, and that the value as compared with other types can be practically determined. But the truck owner who seeks to improve his haulage facilities has no desire to experiment, and he is not willing to justify expenditure by his own judgment, so that there is hesitancy to follow advice or recommendation that may be extremely well founded.

The owner of power wagons may have confidence in his own ideas, but there is more probability that they will fail than there is that they will be productive or economical simply from his lack of knowledge. The value of a systematically developed plan is in the fact that it is usually based on well defined laws and principles and not theory or desire. Those who have engineering data and information of record that is a guide to experience are decidedly more mature in their judgments than are those who hope to accomplish what is at best an uncertainty.

There are in different sections of the country body building specialists, who have for years been engaged in meeting the haulage problems of those who believed it best to turn to experts for advice, realizing that they would have the benefit of accumulated knowledge and equipment that would be adequate in its construction to whatever uses might be made of it. And considering the value of the service the prices demanded were extremely moderate. Naturally those whose experience was the most diversified could be expected to determine problems more satisfactorily.

With the use of motor trucks the experience was without exception that the larger the load carried the greater the economy obtained, and this led to the endeavor to utilize semi-trailers and tractors and trialers, and each form of equipment developed new phases that required careful study. Undoubtedly the semi-trailer and trailer afforded greater load capacity, but the control of the units in use necessitated differing construction than for animal drawn vehicles. This knowledge could only be obtained by experiment, governed by the engineering data obtained with other types of vehicles.

Importance of Hauling Capacity Loads.

In the metropolis the congestion of traffic, the regulations governing it, the loading and unloading conditions, impel positive control of all power driven units, and because the progress of street traffic is governed largely by the progress of the slowest, the conveyance haulage is very costly, unless the loads are to capacity. This condition had been dealt with for years by New York City vehicle builders, and some of them were widely known before motorization became as important a subject as it is today.

These builders were consulted to develop special bodies for differing work, and some extremely interesting designs were constructed. Today there are several firms in New York City who are internationally recognized for the superiority of their constructions. Of these none is better known than the Shadbolt Manufacturing Company, which has a large manufactory in Brooklyn, which is given over to specialization, and which designs and constructs vehicle bodies that are used in all parts of the country. While much truck equipment has been built, trailer and semi-trailer bodies have been developed with extreme care.

The Gasoline Driven Martin Tractor and the Special Body and Semi-Trailer Designed for the Service of the Department of Street Cleaning, New York City.

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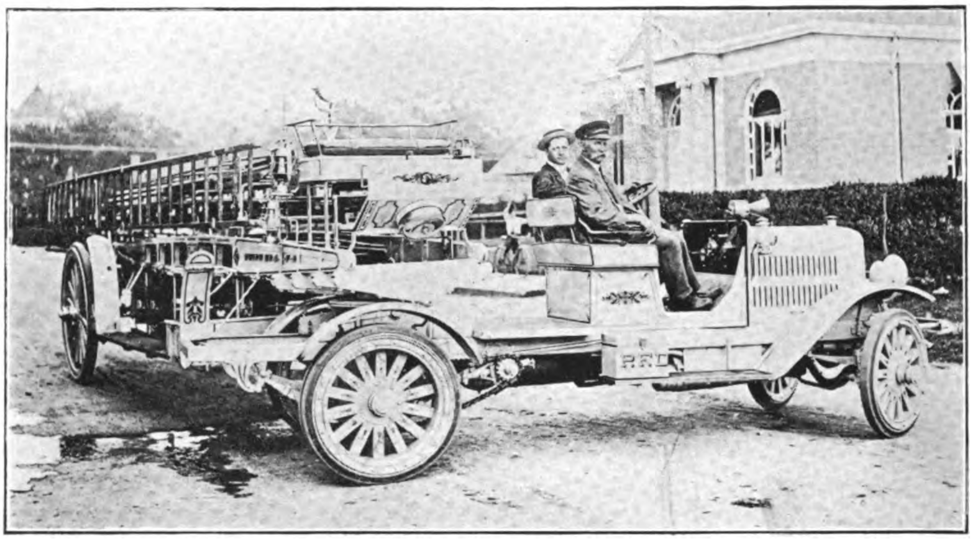


Ladder Truck in the Service of the Patchogue, L. I., Fire Department Motorized by the Use of a Truck Equipped with a Shadbolt Fifth Wheel Coupling.

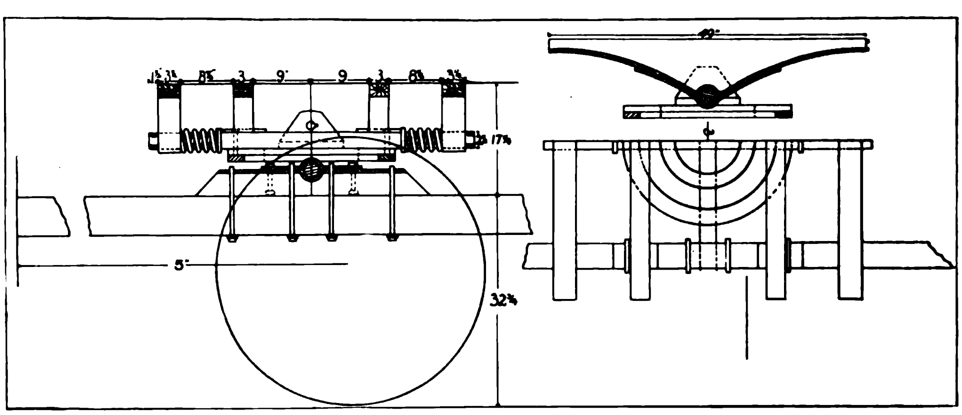
This company owns and manufactures the Shadbolt fifth wheel, which is designed for coupling semi-trailers to tractors and trucks, and which is now used with a considerable number of machines, many of which are in use in New York. Primarily, this consists of a pair of bolsters that are bolted to the side frame members of the chassis which support the ends of a cross shaft, and on this is mounted the lower half of the turntable, this being a circle of heavy steel carrying a large steel cone that is located above the centre line of the axles. This cone is drilled for a key or pin that is intended to lock the turntable when tractor or truck is used, and which can be quickly removed.

The upper half of the turntable is attached to the semi-trailer body frame, it being supported by transverse bolsters, the front and rear bolsters carrying the longitudinal shaft that is so mounted that it has a slight longitudinal movement, there being helical springs surrounding it that are seated against the bolsters. The purpose of the springs is to cushion the truck or tractor and the body against the stresses of starting or stopping. Both the transverse and longitudinal shafts are so mounted that there are no stresses upon either the body or the truck or tractor because of inequality of road surfaces. The cone of the lower section of the turntable is large and forms a pivot for turning, and its shape makes for easy coupling the tractor and the body.

Some of the equipments with which this coupling are used are illustrated to show the types of bodies that have been designed to meet conditions in which ordinary constructions would not be economical. One of these is a garbage collecting body drawn by a battery driven electric tractor in the service of the Bureau of Street Cleaning of the Borough of Richmond, which includes Staten Island, New York City. This is an enclosed construction, mounted on a frame with what is known as a "gooseneck" carried on the rear of the tractor, this frame being hung low between two large wheels.

The loading is done from the rear, the men carrying the containers into the body and emptying them ahead of the sliding tail gate, that is slidable on side rails on the sides, and which may be locked with levers. The body is hoisted by a motor driven by current from the battery. A chain first carries up a strut on which is a sheeve, through which a chain is passed. When the strut reaches a certain point it is held by chain guys and then the chain through the sheeve elevates the body to a maximum height.

There is also illustrated a type of semi-trailer that is used with a Martin tractor by the Department of Street Cleaning of Manhattan, which has a large body that is carried on a long frame similar in general design to that used with the smaller equipment. This body is long and low, so that it may be loaded readily from the street, and it is covered to prevent the contents being shaken out while the tractor is under way. The rear end of the body is pointed transversely so as to make discharging easy. There is no hoisting apparatus, for the outfit carries its loads to a dock where these are discharged into scows. The body is backed under a tower and sling hooks are caught in rings in the sides near the forward end, and the body is lifted to any height that may be necessary to discharge the contents. With a permanent place of discharging this plan for discharging is economical, as one hoist will serve a large number of machines. Another illustration shows the Shadbolt equipment installed on the rear deck of a KisselKar truck that is used as a tractor for a ladder by the fire department of Patchogue, and which affords every utility.



Sectional Drawings Showing the Detail of the Shadbolt Fifth Wheel, Designed for Trucks and Tractors Drawing Semi-Trailer Equipment.

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THE GEVECO TRUCKING SYSTEM.

New Method of Increasing Daily Mileages of Electric Vehicles, that Obviates Owners' Troubles and Determines in Advance the Operating Cost Per Mile.

By DAY BAKER.

EVER since the transportation world has recognized the value of the motor truck as a medium for carrying merchandise, it has invariably been admitted in the larger cities where there are opportunities of testing the various forms of trucks, that while the gasoline motor driven vehicle is especially adapted for long hauls, the electric wagon and truck is the desirable and economical vehicle for city and suburban work.

A G. V. Electric Wagon Operated by the Geveco Trucking System by the O. K. Bakery of Hartford, Conn.

This is clearly shown by the many and large installations of electrics which have been made by the conservative buyers of transportation facilities, who have no ulterior motive—whose sole object is to secure the prompt and reliable delivery of merchandise at the lowest cost per package or per ton.

Of course there are other factors which may influence the purchaser in his decision of the special type of vehicle to be adopted, for assuming that while a vehicle is operating it is doing its work with speed and apparent economy, the actual cost of delivery per package or per ton may be materially increased by the days per year that the vehicle is out of service for minor or major parts or adjustments.

It is in the days per year in service, as well as its extremely long life, that the electric wagon and truck stands pre-eminent and has enabled the transportation engineer to show figures of economy and reliability which excel any which have been produced in actual service by advocates of other forms of transportation. As proof of the foregoing statements, it is only necessary to consider just a few of the installations made by the great buyers of transportation facilities.

Some Evidences of Approval.

The American Express Company has been a consistent buyer of all forms of trucks for the past seven years. It has now about 300 electric wagons in use and the additions to its various fleets during the fall and winter of 1915-16 are practically all of the electric type.

The Adams Express Company is this month receiving the final shipment of some 42 two-ton General Vehicle electric wagons, which makes a total of 191 wagons of this make purchased by this company.

The Jacob Ruppert Brewing Company, New York City, has 125 five-ton General Vehicle electrics; George Ehret of the same city has a like number; the Peter Doelger Company has 66 General Vehicle trucks, while the Anheuser-Busch Brewing Company of St. Louis has over 60.

In the lighter class of delivery wagon the department stores have shown a preference for the electric. Lord & Taylor, B. Altman & Co., R. H. Macy & Co., Gimbel Bros., Stern Bros., the Tiffany Company, the Bonwit-Teller Company, the Franklin Simons Company of New York; the Marshall Field Company, The Fair of Chicago; Woodward & Lothrop of Washington, D. C.; the Houghton & Dutton Company of Boston, and the Bullock Company of Los Angeles, Cal.,

One of Three Five-Ton G. V. Electric Dumping Trucks Operated by the Geveco Trucking System for Coal Haulage by the Burton-Furber Coal Company, Boston, Mass.

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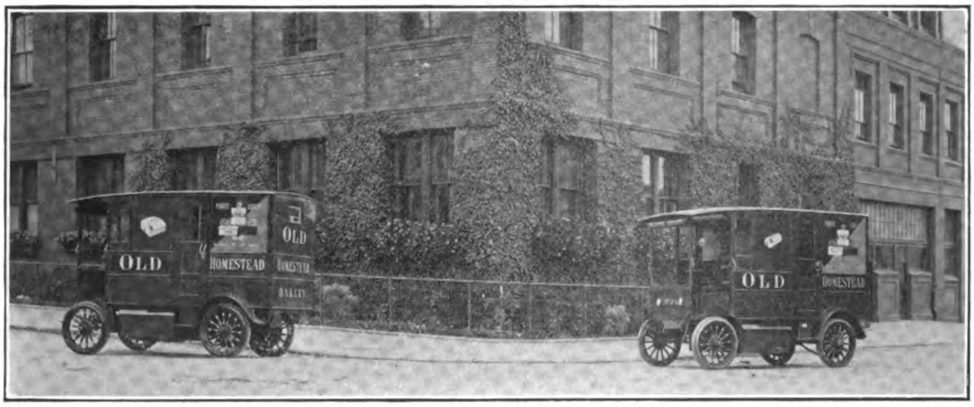


One of a Fleet of Seven One-Ton G. V. Wagons Operated by the Old Homstead Bakery of San Francisco—The Geveco Trucking System Is Operated in That City by the Pacific Gas and Electric Company.

all operate large fleets of electrics.

In fact, the list of users of electric vehicles could be extended to cover many pages of this publication, but it is not the purpose of this article to show the present high esteem in which the electric vehicle is held, but to explain the new "Geveco Trucking System—The Trouble Proof Method."

Reasons Militating Against Electrics.

With all the desirable qualities possessed by electric vehicles, they have not been as freely purchased as could be desired, and in reviewing the objections advanced by users, as well as the arguments which are recited by the manufacturers and salesmen of competing lines, it was found they could all be reduced to four reasons:

First—High initial cost of vehicle.

Second—Uncertainty in the layman's mind as to the efficiency, life of battery, and its care.

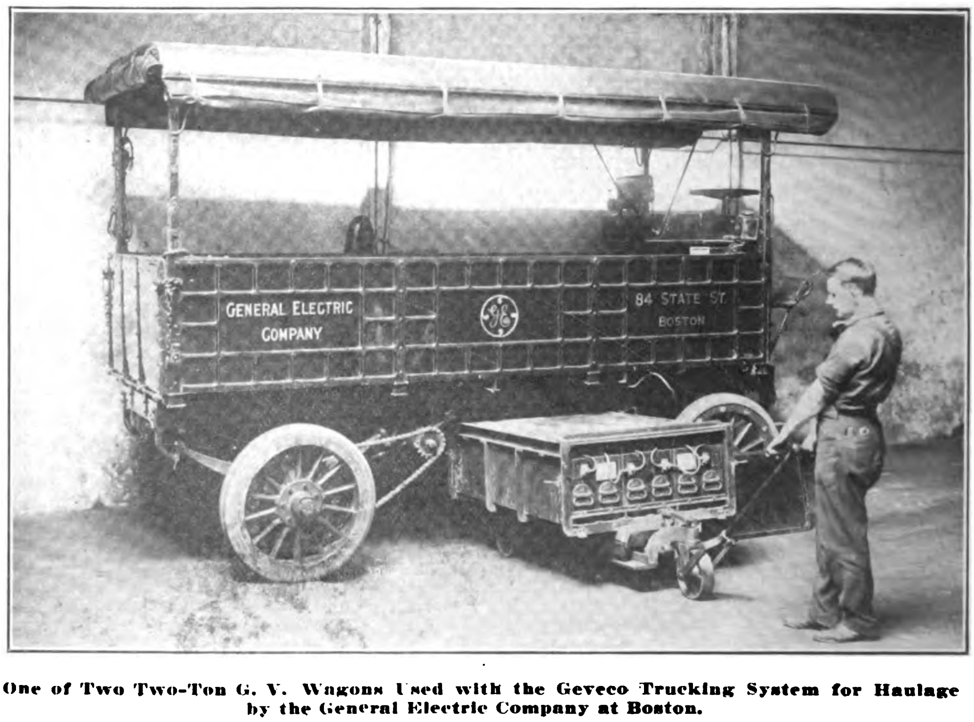
Third—Limited mileage on one charge of battery.

Fourth—Uncertainty as to actual cost of battery operation.

It could be readily seen that with the removal of the above objections the popularity of the electric vehicle would be assured, and, therefore, it was deemed necessary to devise a system which would eliminate, in the mind of the public, the four limiting factors mentioned.

Exchangeable batteries could be used to obtain long mileage, and it was found that exchangeable batteries had for some time been used in private installations, but the idea had never been practically developed on an economical basis suitable for general commercial use.

Another point that seemed very hazy in the mind of the average user or prospective buyer of an electric truck, was the mileage value of a kilowatt-hour. Merchants do not understand ampere-hours, kilowatt-hours, specific gravity and like electrical terms. They like to deal with words which they fully understand. At this point Mr. A. C. Dunham of the Hartford Electric Light Company came to the assistance of the vehicle operators and devised a system by which the owner of an electric vehicle could be charged for the electricity used "by the mile." Exchangeable batteries and electricity by the mile were united, and building on these factors there was gradually evolved a system for the operation of electric vehicles which is now known as the "Geveco Trucking System—The Trouble Proof Method."



One of Two Two-Ton G. V. Wagons Used with the Geveco Trucking System for Haulage by the General Electric Company at Boston.

The Geveco Trucking System.

Under the Geveco trucking system the difficulties of the introduction of electric vehicles are overcome as follows:

First: The vehicle is sold without battery and, therefore, the purchaser's original investment is reduced 20 to 38 per cent.

Second: The vehicle user purchases no battery, owns no battery, cares for no battery and, therefore, has no concern except to operate the vehicle.

Third: As the Geveco trucking system provides for the exchange of batteries as often during the day as required, the limitation of mileage is removed, and as many miles may be run as required for the day's work.

Fourth: As the Geveco trucking system con-

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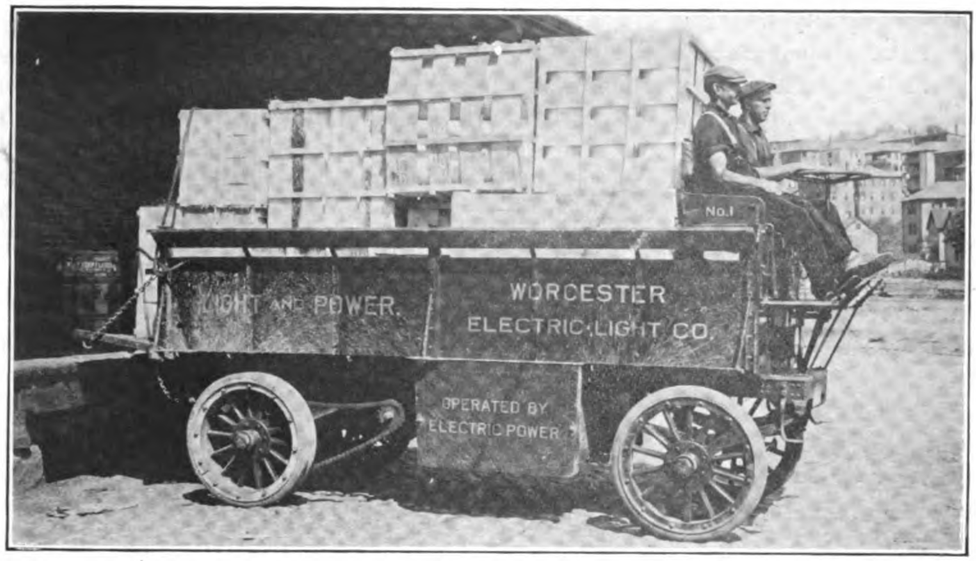


One of Nine Electric Trucks Operated by the Worcester, Mass., Electric Light Company, on the Geveco Trucking System.

templates a standard scale of charges, the actual cost per mile, per day, per month or per delivery can always be ascertained; frequently predetermined.

This reduces the operation of electric vehicles to the simplest possible form, and means to truck users:

A substantial reduction in truck investment; no charging apparatus or garage investment; unlimited mileage and continuous service from trucks; busy season difficulties and bad roads overcome; relief from care of batteries and a reduction of all items of battery cost, including current, to a definite basis of miles travelled per month.

The Geveco trucking system of inspection of vehicles assists the user and prevents small troubles becoming the source of delays in service.

An Outline of the System.

When vehicles are sold to be operated on the Geveco trucking system, the purchaser buys an electric vehicle without a battery, but it is supplied with a specially designed detachable cradle for a battery. It is by the use of these cradles that the company furnishing power is enabled to exchange a discharged or partly discharged battery for a fully charged battery in from two to five minutes. This feature enables the user of the electric vehicle to obtain practically unlimited mileage.

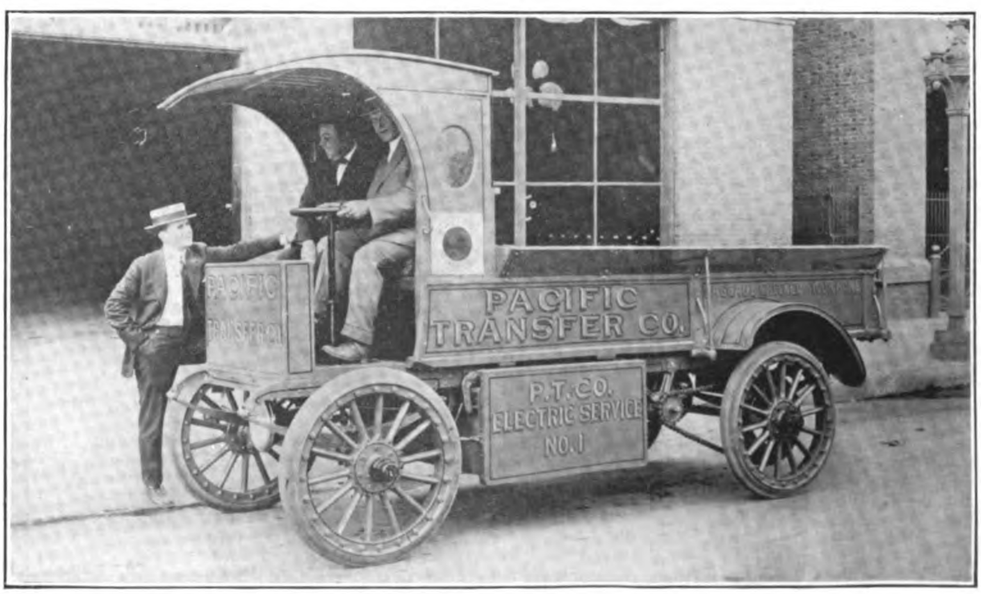
The purchaser of a G. V. wagon contracts with the company operating a Geveco trucking system to furnish all power for operating vehicle, supplying charged batteries as often as may be required to keep the vehicle in operation for as many hours per day as the owner may deem desirable. In some cases where extra long mileage is desired, batteries are exchanged two or three times per day.

The company furnishing power makes a monthly charge for the service; i. e., having batteries on hand ready to exchange at any time, and then the power used is charged at a certain rate per mile, as recorded by the odometer, according to the size of the vehicle. The ready exchange of batteries eliminates driving restrictions because of grades. It also relieves the merchant of troubles which come with snow covered streets, and the extra rush trips required during the holidays. In fact, the Geveco trucking system admits of operating the vehicle 24 hours a day should this be necessary.

Cost Can Be Definitely Known.

The uncertainty as to the cost of operating frequently deters a merchant from purchasing a motor wagon, but under the Geveco trucking system he can from tables be shown in advance the exact cost in detail for the operation of a vehicle per month and per mile with all the principal items definitely fixed. The usual schedule of charges under this system encourages the use of vehicles for the greatest possible mileages on account of the decreasing cost per mile as the mileage increases.

That the purchasing of electric power by the mile



One-Ton G. V. Electric Wagon Operated on the Geveco Trucking System by the Pacific Transfer Company, Spokane, Wash., for Express and Transfer Service—During the Year Ending Aug. 15, 1915, This Machine Was Driven 20,000 Miles.

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is popular is shown by the fact that in one city where this system is in use, 65 per cent. of the present electric fleet replaced gasoline driven vehicles, and in each case the user has stated that he would not consider returning to the use of gasoline motors.

The public service light and power companies in nearly a dozen cities of this country have agreed to adopt the Geveco trucking system and furnish electricity for teaming purposes by the mile.

When the System Works Out Well.

Hartford, Conn., already has a fleet of 68 electric wagons operating on the system. In this city 17 times more electric vehicles per population are being sold than in the average city where the Geveco trucking system is not operated. One grocery store is operating eight electric delivery wagons, while one milk dealer who has a farm some seven miles from the changing station, delivers 1000 quarts of milk over two routes in Hartford with his 2000-pound General Vehicle electric. Over 325 customers are served by the boy who drives the vehicle. He leaves the farm at 6 o'clock in the morning and is back at the farm with his load of empties at 1:30 o'clock in the afternoon, having changed his battery on starting his return trip.

At Spokane, Wash., a number of vehicles are in operation on the Geveco trucking system. One of the vehicles on this service is a one-ton General Vehicle truck, owned by the Pacific Transfer Company, who state that this vehicle runs seven days a week 18 hours a day, 20,000 miles a year, and is costing them for service charge, power and extra charges, 5.87 cents per mile. And this in spite of the hills and many poor roads around Spokane.

Progress in Other Cities.

Boston has recently adopted the Geveco trucking system and already a large fleet of postal service wagons, two machinery delivery trucks and three five-ton coal trucks are in successful operation under this system.

Worcester and Fall River, Mass., are prepared to furnish the system to users of General Vehicle electrics. Worcester already has a good sized fleet of electrics which is being served at a charging station.

San Francisco, Cal., with its many and steep hills, has some 40 electric trucks in operation with success, and with the idea of increasing the electric truck fleet the Pacific Gas and Electric Company is now offering electric power for trucking by the mile on the Geveco trucking system.

Baltimore, Md., has a rapidly increasing electric truck fleet, which is being augmented by the efforts of the Consolidated Gas, Power and Light Company, which not only sells electric trucks, but is charging on the per mile basis those entered on the Geveco trucking system.

Los Angeles, Cal., will on Dec. 1 be prepared to serve its customers by the Geveco trucking system, and undoubtedly the fleet of some 36 General Vehicle electrics will be greatly augmented as soon as the progressive merchants of that city discover that they can now buy electricity by the mile for trucking.

A table showing the rates adopted by a number of the operators of the Geveco trucking system is given.

The principal reason that will make the Geveco trucking system a success is that it removes the misunderstandings that heretofore have always existed between the man who has goods to move and the man who desires to furnish electric power to move them. No longer is it necessary to explain all the intricacies of the chemical and

Table of Charges Geveco Trucking System—The Trouble Proof Method.

Prices Per Month.

	Boston	Spokane	Baltimore	San Francisco	Hartford	Charges Recommended*
1000-lb. wagon:						
Garaging	$19.00	....	$19.00	....	$8.33	$19.00
Battery service and inspection	17.00	$40.00	17.00	$42.50	14.00—	17.00
Rate per mile, 0 to 500....	.03	.03	.03	.03	.03	.03
Rate per mile, 501 to 750....	.02½	.02½	.02½	.02½	.02½	.02½
Rate per mile, 751 to 1000....	.02¼	.02¼	.02¼	.02¼	.02¼	.02¼
Rate per mile, excess of 1000	.02	.02	.02	.02½	.02	.02
2000-lb. wagon:						
Garage	19.00	....	19.00	....	8.33	19.00
Battery service and inspection	21.00	42.50	21.00	45.00	21.00—	21.00
Rate per mile, 0 to 500....	.03½	.03½	.03½	.04	.03½	.03½
Rate per mile, 501 to 750....	.03	.03	.03	.03½	.03	.03
Rate per mile, 751 to 1000....	.02½	.02½	.02½	.03½	.02½	.02½
Rate per mile, excess of 1000	.02¼	.02¼	.02¼	.03½	.02	.02¼
4000-lb. wagon:						
Garage	19.00	....	19.00	....	10.00	19.00
Battery service and inspection	28.00	50.00	28.00	55.00	—	28.00
Rate per mile, 0 to 500....	.05	.05	.05	.05	.04½	.05
Rate per mile, 501 to 750....	.04½	.04½	.04½	.04½	.04	.04½
Rate per mile, 751 to 1000....	.04	.04	.04	.04	.03½	.04
Rate per mile, excess of 1000	.03½	.03½	.03½	.04½	.03	.03½
3½-ton truck:						
Garage	23.00	....	23.00	....	....	23.00
Battery service and inspection	33.00	60.00	33.00	65.00	—	33.00
Rate per mile, 0 to 500....	.06	.06	.06	.06	.06	.06
Rate per mile, 501 to 750....	.05½	.05½	.05½	.05½	.05	.05½
Rate per mile, 751 to 1000....	.05	.05	.05	.05½	.03	.05
Rate per mile, excess of 1000	.04½	.04½	.04½	.05½	.03	.04½
Five-ton truck:						
Garage	26.00	....	26.00	....	....	26.00
Battery service and inspection	36.00	70.00	36.00	75.00	—	36.00
Rate per mile, 0 to 500....	.07	.07	.07	.07	.07	.07
Rate per mile, 501 to 750....	.06½	.06½	.06½	.06½	.06	.06½
Rate per mile, 751 to 1000....	.06	.06	.06	.06½	.04	.06
Rate per mile, excess of 1000	.05½	.05½	.05½	.06½	.04	.05½

Garaging includes the garage space, washing, oiling, greasing and ordinary minor adjustments.

Battery service and inspection include readiness to serve with electric energy in exchangeable batteries, to enable the customer to run his vehicle at any time, and inspection as to the condition of the vehicle at the station of the company.

*The charges in this column are those included in the contract from which the General Vehicle Company has standardized for the customer. These standards are based on preliminary experience accumulated by the different cities listed and by the General Vehicle Company. Variations in charges for battery service and inspection are caused by variations in freight rate on batteries. The standard charges for rate-per-mile costs tabulated in the last column are recommended by the General Vehicle Company as maximum charges after wide investigation and analysis of local conditions, rates for energy and so on.

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electrical characteristics of the storage battery, or the charge per kilowatt-hour, which means little to the average merchant, but now the vendor of electric current can say to the merchant, "If you put in electric wagons or trucks on the Geveco trucking system I will sell you power to operate them and charge you by the mile."

FARM TRADING FROM A TRUCK.

A country storekeeper of O'Leary, Ia., is using a Little Giant truck in his trade with surrounding farmers. He stocks the truck with goods and drives among the farms, selling anything from a thimble to a suit of overalls. He accepts pay in butter and eggs or other farm products, which he carries back for his own trade.

NOVEL DEPRECIATION SCHEDULE.

The Larkin Company of Buffalo, which operates 13 trucks, has adopted a novel plan for charging depreciation. Instead of 20 per cent. a year the company charges off the first year 33 1/3 per cent. of the cost of the truck, and the next year 33 1/3 per cent. of the remaining two-thirds, and so on indefinitely.

Thus, if a truck cost $3000, the first year's depreciation would amount to $1000, the second year's depreciation to $666, the third year to $444 and the fourth year to $296.

The scale has been adopted because it takes care satisfactorily of the heavy initial depreciation which results when a new vehicle is put into service and because it tends to equalize increasing repair and maintenance charges which grow greater with the use of the machine. It is undoubtedly more accurate in the last years of truck use than charging off the entire value of the machine in five years.

Frank A. Vanderlip, president of the National City Bank of New York City, has been elected a director of the new S. K. F. American Ball Bearing Company, which is to be located in Hartford.

The Meyercord Company of Chicago is producing for advertising purposes imitation oil paintings of factories and trucks which are so artistic that many are deceived by them.

A factory addition 40 by 60 feet is being erected for the Gemmer Manufacturing Company of Detroit, which makes steering gears for motor vehicles.

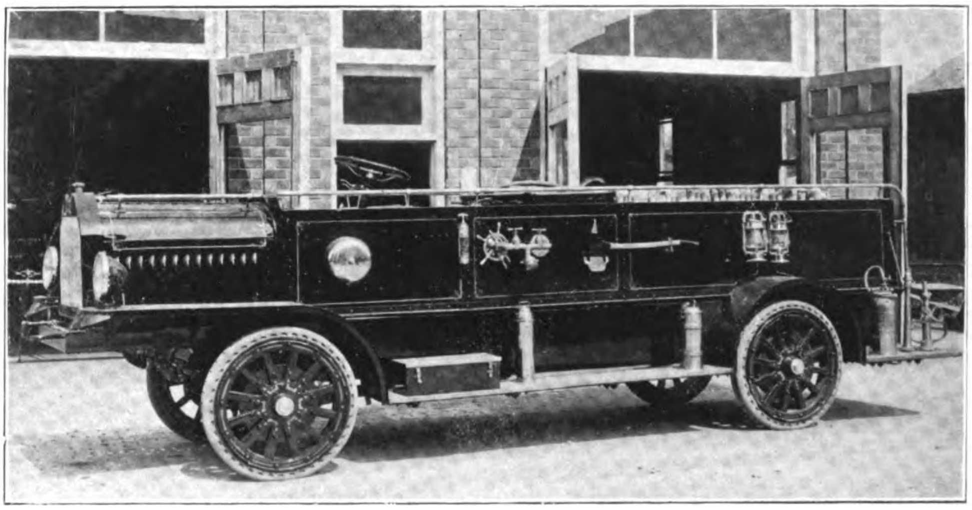
DUPLEX FIRE APPARATUS.

Four-Wheel Driven Internal Gear Equipment Developed for Municipal Work.

Because of the efficiency of its vehicles in any operating conditions, as well as the extreme maintenance economy, the Duplex-Power Car Company, Charlotte, Mich., builder of Duplex trucks, has established a department that will produce machines especially adapted and equipped for fire fighting.

The apparatus will include hose wagons, chemical wagons, combination hose and chemical wagons, trucks carrying manually and mechanically operated ladders, as well as fire pumps, and some of the latter will be combined with the usual hose and chemical equipment. The regular pumping engines will have capacity from 350 to 700 gallons a minute.

As Duplex machines have traction at all four wheels, they can be driven on grades that are not passable for vehicles driven with two wheels, and in conditions such as snow or mud, where progress would be very slow, if not impossible, for apparatus of other types. Not only is there certainty of continuous service, because of the peculiar utilization of power, but there is less probability of damage from any of the causes that might eventuate in fire service. Not only this, there is a very great saving in tires and skidding is practically obviated.



Duplex Four Wheel Internal Gear Driven Chassis Equipped as a Combination Hose and Chemical Apparatus in the Service of the Charlotte, Mich., Fire Department.

Because of the low centre of gravity there is no reason to apprehend danger, no matter what the speed attained. While these machines are designd to be steered by the front wheels, when equipped with ladders they are constructed to be steered at both ends, this affording a maximum of safety in making fast runs and turning sharply. The factory is now producing a number of these apparatuses, which will shortly be delivered to purchasers. The accompanying illustration shows an apparatus in the service of the fire department at Charlotte, Mich.

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SPECIAL HOTEL OMNIBUS.

Two Machines on Truck Chassis Built by the Chase Motor Truck Company.

The Chase Motor Truck Company, Syracuse, N. Y., has just completed and delivered to the Hotel Onandaga, in that city, two special omnibuses, designed for service between the hotel and the different railroad stations of that city. The machines are intended for transporting considerable freights, and are larger and heavier than vehicles usually built for this purpose.

The Onandaga is one of the largest and most pretentious hotels in central New York. The hotel company had smaller vehicles in service, but the demands upon them were so great and the use continuous from early morning until late at night, that the company decided to obtain machines designed especially for its purposes.

One of Two Chase Worm Driven Two-Ton Truck Chassis Equipped with Passenger Bodies for Transporting the Guests of the Hotel Onandaga, Syracuse, N. Y.

The chassis are the standard two-ton load capacity type, fitted with large pneumatic shoes forward and dual solid band tires at the rear, and on these are built bodies that have seats for 20 passengers. There are two entrances, both side doors, at the front and rear, and the French bevel plate glass windows are arranged to be raised or lowered with hand wheels. The seats are uphlostered with gray silk mohair. The interiors of the 'buses are heated by radiators through which the exhaust gasses pass. There are clear vision windshields to protect the driver. The machines are driven from the right side. The vehicles have all the refinements desirable for the work in which they are operated, and are especially sightly in appearance.

The Wallis Tractor Company, formerly of Cleveland, O., has removed to Racine, Wis. A large part of the Racine-Sattley Company's works has been leased.

AMERICAN TRUCKS MAKE GOOD ABROAD.

According to James G. Shelley, a truck inspector for the Packard Motor Car Company, who spent a year in Petrograd, the service of American made motor vehicles in Europe has given them a high place in the estimation of the people at war on a basis of quality, and they have an assured commercial future after the war. Shelley was not near the front, but he was in a position to know the current opinion about the various trucks. Fred Schaefer, another Packard employee, who has been in Petrograd, will return there in about two months.

HIGH COTTON PRICES IN SOUTH.

The raise in the price of cotton to a very satisfactory level for southern growers has greatly increased the sale of passenger cars and trucks in that part of the country. In many cities the dealers have been getting more orders than it is possible for them to fill.

A year ago business conditions were very bad in the South through the low price of cotton because of inability to sell the crop abroad. This led to the planting of a smaller crop this year and its cultivation in a very much cheaper way. Now the price is high and an amount of money equal to that of the best years will be realized from the crop. The proceeds will also represent more profit because of the lower cost of growing.

The South also took a good lesson from its 1914 experience and this year planted a greater variety of other crops. These are bringing high prices and all in all the southern farmer has the most valuable crops to sell that he ever had.

TWO WAR ORDERS FOR TRACTORS.

The Knox Motors Company recently received two orders for 25 tractors from two of the belligerent countries. The larger part of the Knox business, however, is domestic and the war business has been limited.

The Champion Auto Equipment Company, Chicago, Ill., has purchased a plant at Wabash, Ind., where it will manufacture automobile tires.

The Central Machine and Supply Company, New York City, will establish a plant at Boontoon, N. J., for manufacturing automobile parts.

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APPLICATION OF WORM DRIVE TO MOTOR TRUCKS.

By HAROLD E. WARING, Pierce-Arrow Motor Car Company.

IN THE endeavor to have an article on this subject at least look as if it might be interesting to the reader, all formulae, together with equations containing several unknowns, etc., are conspicuous in their absence. Moreover, the discussion will be as non-technical as the character of the topic will permit, and inasmuch as the experience of the writer has been with the pioneers of the worm driven motor truck in America, the Pierce-Arrow Motor Car Company, it follows that the application of the worm drive will be considered from a Pierce-Arrow standpoint.

Reliable data is not to be found in ordinary text books on this subject; also, what experiments have been made have been the result of careful investigation, involving considerable expense and covering several years. Naturally, there is some reticence on the part of those possessing such an advantage in giving out information broadcast, hence, we will simply proceed on the basis of knowledge gained through constant association with the worm drive and its characteristics.

The application of this method of propulsion is by no means a novelty.

An Evidence That the Worm and Gear Transmission of Power Is Not a Recent Engineering Conception.

Back in the 16th century in one of the great pageants of that time the worm drive was proposed as a means of transmitting motive power in an emblematic car, and we have proof of this fact in a wood cut of such a vehicle now resting in the British museum. Practical English experience, however, reverts back to a period of more recent date when Lanchester incorporated this final type of drive in the passenger car which now bears his name. Following closely upon this work, the Dennis brothers in 1903 employed the worm drive in trucks of their own manufacture, differing then somewhat in form from the present type in that the worm was placed underneath.

It is significant to note in this connection that this company adopted the principle in all models of their cars, including their touring cars, and have since adhered to this policy. In 1907 the J. & E. Hall Company of England introduced the worm drive in three-ton omnibuses which were used in public service, and at this same time Halley of Glasgow commenced to build worm driven trucks. The Leyland Motor Company soon took up the worm, and during 1908 was followed by the Napier Company of London, as well as by the Daimler Company of Coventry. At the present time such rapid progress has been made in this respect that there is hardly an English manufacturer of prominence who does not incorporate the final worm drive in at least some one of his models.

In 1905 the Pierce-Arrow Motor Car Company became so impressed with the possibilities of the motor truck that a model was manufactured for experimental purposes. This truck represented the last word in American truck engineering at that time, including the well known chain drive, and it was subjected to the most gruelling and difficult series of experiments that could be devised, as well as a long period of practical work. As a result of their experiments and observations on this truck, the officials of that company became convinced as to the ultimate impracticability of the chain drive construction, and, therefore, determined to investigate foreign practise. Naturally, their attention turned first to England, where motor transportation was at a more advanced stage, and after a thorough investigation of the worm, covering various points which we will discuss later, they decided to adopt this type of drive.

The fact that there was an immense amount of prejudice against the worm at that time is not surprising.

Worm gears had been manufactured which, being neither accurate nor of correct design, were, of course, a failure, and gave rise to an entirely erroneous attitude toward this form of construction. Even at this

late period numerous difficulties will be encountered if the greatest care is not taken in the design, the manufacture and assembling of this mechanism.

Worm a Reversible Type.

Perhaps it will be advisable to distinguish the type of worm used in the automobile construction from that ordinarily employed on elevators, etc. The former is of the reversible type in that power applied to the worm wheel will drive the worm, thus enabling the car to coast; while the elevator type is known as the non-reversible construction. This latter is often employed where great leverage is desired in a small, compact space, and it has the locking feature which is so desirable in some kinds of construction, notably to prevent an unwinding of the mechanism. Reversibility is obtained through the proper selection of the pitch angle of the worm, and ignorance of this feature is alone accountable for the claim which used to be made that worm driven trucks could not coast.

An Example of the Service in Which the Worm Drive Has Been Found to Have Met Every Requirement.

When we consider mechanical efficiency, we mean the proportion of power given out by any type of construction as compared to the amount of power put in; and in the case of the worm and worm gear it is possible to design this construction so as to obtain an efficiency of 95 per cent., which is the highest of any type of speed reduction gearing. That this efficiency remains constant throughout the life of the worm drive construction is due to the nature of the action of the worm against the worm gear. You may call it rubbing if you wish, but its action may be likened to that of a wedge, and as long as the face of contact remains constant the efficiency is not impaired to any appreciable extent. "Back lash" or lost motion may occur in the course of wear, but it will have no effect on the efficiency. Contrast all this with the decline in efficiency common to all forms of bevel and spur gearing, caused by the surfaces in contact gradually changing until ultimately there is danger of stripping.

At this point it might be well to note one or two other reasons why the bevel type of construction was set aside—viz., the size of gear required for the reduction necessary in a motor truck renders accurate manufacture practically an impossibility; and the size of the housing necessary to contain such a gear construction does not permit of its use.

The Advantages of Worm Drive.

The worm drive as a means of final power transmission, in contrast with the chain drive construction, possesses several distinctive advantages in its favor.

In the first place the life of the ordinary chains is a matter of chance at the most, inasmuch as a chain is only as strong as its weakest link. While the manuturers of chains give no guarantee whatsoever concerning their life, which is usually never more than 10,000 miles, the extreme longevity of the worm drive has already been proven by the immense amount of mileage obtained on trucks embodying this construction. In this connection the writer has personal knowledge of a worm and worm gear having run over 100,000 miles to date, and it bids fair to add many more miles to this already enormous mileage. A feature which follows in importance, and is in a sense derived from the life of the worm, is reliability. Even now manufacturers of the worm drive guarantee this construction for a mileage running into the thousands, and so firm has become the belief in the actual performance of the worm that individuals have gone as far as to guarantee mileages of 30,000 and more.

In regard to the expense connected with this type of drive, it is only fair to say that the worm and worm gear costs more to manufacture than any other type of final drive, but we believe that this expense is considerably more than offset by the longevity of the worm construction. Maintenance of the worm gear in the matter of lubrication is negligible, an item which contrasts strongly in its favor as against the various other types. The fact that the worm drive is entirely enclosed and away from the elements, as well as from the effects of carrying such commodities as coal, sand, gravel, etc., precludes any unnecessary wear due to outside sources.

Noticeable Silence of Operation.

One more feature which is instantly noticeable to the ordinary lay man is the silence in operation of this type of drive. We have often heard the remark that noise is wasted energy, and it would seem that the worm and worm gear transmits all of its energy if this were true in every case. An incident which is recalled by the writer had a tremendous bearing on this silent

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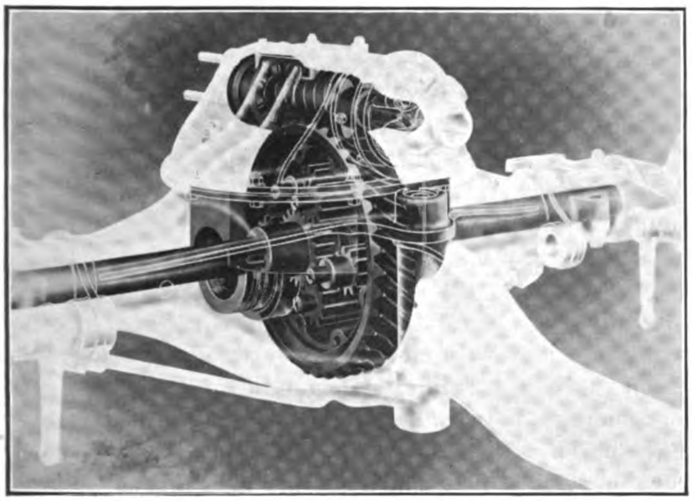


Phantom View of the Pierce-Arrow Worm Shaft and Gear Wheel Construction.

feature of the worm driven truck. It seems that through a certain community in New Jersey not far from the great city of New York, there was a seemingly endless parade of heavy motor trucks working on a large contract in that vicinity. The noise created by these trucks was a source of constant objection to the townspeople, for the trucks were operated during both night and day. Now, since both chain driven and worm driven trucks comprised the equipment engaged in this work, and the community had no complaint whatever to make against the worm driven trucks, it was necessary eventually to operate only the worm driven trucks during the evening hours. The immediate cessation of hostilities is self-explanatory.

Essentials of Construction.

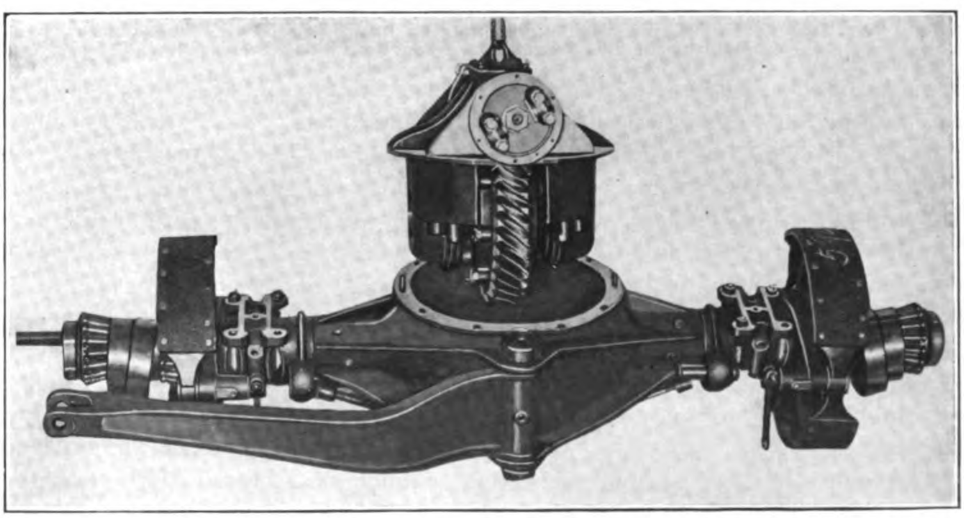
Now for the construction of the worm drive. Inasmuch as the worm itself rotates much faster than the worm wheel according to the ratio of the gear reduction, it has been found necessary to manufacture the worm of special steel which is case hardened, while the worm wheel is made of a special bronze material. Thus it is evident that the wear taking place on both units will be relatively even and they are made large enough to guarantee long usage. A steel casting constitutes the housing for the worm and worm wheel, and the annular ball bearings which are used to take the radial and thrust loads, are extremely large, being capable of withstanding a very severe strain—which, however, is only momentary. A spur gear differential is included within the worm wheel construction with fluted driving pinions, and the entire mechanism is constructed so as to drop in a stout steel casting called the "bowl," which is oil tight for lubrication purposes.

As to the method of adjusting the worm and worm wheel so as to establish their best working positions and thereby render the greatest efficiency, first, the worm must have a bearing throughout the face of the worm gear tooth, and still be free enough to run smoothly. In order to obtain this position the worm and wheel are run together temporarily with the teeth of the worm gear daubed thoroughly with Prussian blue, and the contact carefully noted. Next, having adjusted the worm wheel to get the proper bearing throughout the face of its teeth, and ascertained the exact position in the steel retainer housing, steel distance rings are cut to the proper thickness and inserted with the bearings. The assembly is then bolted together firmly and it is impossible thereafter for the worm wheel to change its relative position with the worm.

In the design of the rear axle the tremendous road shocks and vibrations must be given careful consideration as to their effect on the worm and worm gear. With this in view, the driving shafts, although securely fixed to the hubs of the road wheels, are designed to slide freely in and out of the differential pinions from which they are driven, and by this means none of the road stresses are transmitted to the worm and worm gear. The rear axle assembly is, of course, the full floating type, the load being carried upon heavy roller bearings mounted upon the housing, and the live axles sustaining only the tortional stresses of driving.

Lubrication Adequate and Positive.

With regard to the manner of lubricating the worm drive, the bowl contains only an amount of oil necessary to slightly immerse the worm wheel. When running the oil is carried up by the worm wheel and by means of a patented arrangement on either end of the worm shaft—consisting of a short worm thread running in the opposite direction to the thread of the driving worm proper—the oil is injected through the annular and thrust bearings which hold the worm. Draining by gravity back into the bowl produces a constant circulation of the oil, and thereby a very ef-



A Pierce-Arrow Rear Axle with the Worm Shaft and Gear Wheel Hoisted from the Housing as a Unit Assembly by Removing a Series of Bolts and the Axle Shafts.

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ficient means of lubrication. A petcock is placed in the rear of the bowl as a check in keeping the proper level of oil, and a drain plug in the bottom enables complete removal. The source of supplying oil to the construction is through a cap on top of the worm housing, and it is necessary in removing this cover to exercise the greatest care so as to prevent any foreign substance from getting into the bowl. The result of carelessness in this particular by way of damage to the mechanism is self-evident. The best oil for lubricating the worm drive has been determined by long experience to be an ordinary heavy cylinder oil which will not thicken nor solidify during cold weather, and practise has shown that it will not be found necessary to change this oil until the truck has been driven at least 5000 miles.

Power a Matter of Gear Reduction.

In conclusion the writer would like to remark on various points which have been brought up by opponents of the worm drive construction. As has been stated before, many of the reflections cast on this type of drive are due simply to ignorance and prejudice, but on the other hand there are some points that at times may have caused the advocates of the worm gear drive considerable embarrassment when confronted with them under trying circumstances. Concerning the point brought up that the worm drive does not give adequate power when subjected to severe tests, hill climbing, etc., this is simply a question of gear reduction and can be adjusted very readily upon a thorough knowledge of the conditions under which the truck must operate. The old time, familiar statement that the worm drive would not "stand the gaff" has been wholly disproved by the records now existant of trucks employing this type of drive; but we must admit that there will continue to be failures among worm driven trucks that are: First, carelessly designed; second, poorly manufactured, and third, improperly assembled.

This Truck Was Driven More Than 20,000 Miles on One Set of Tires—An Illustration of the Flexibility of the Worm Drive Starting and Accelerating.

The question of unsprung weight in connection with worm driven rear systems is best answered by the records of tire mileages obtained in actual practise. Since the rear tires would be most likely to suffer in this respect, and there is abundant mileage data available on worm driven trucks, it appears that any weakness along these lines is entirely contradicted. This same reasoning eliminates the destructive results from a sudden thrust upon application of power attributed to the worm drive, although along these lines we are quite familiar with the snapping of chains on chain driven rear systems.

Finally, we beg to contradict the statement often heard that the worm drive generates a tremendous amount of heat. While we grant that heat is a product of energy, nevertheless, if one were to carefully examine the bowl of the rear axle on any worm driven truck he would find the paint in the usual ordinary condition, not exhibiting in the least the cracked appearance that is always the effect of intense heat.

While these statements are entirely of a practical nature, they will help to alleviate the doubt that is always occasioned in the minds of those who are not thoroughly familiar with the worm drive as a final type of power transmission.

NEW TRUCK SEARCHLIGHT.

For use on motor trucks at night, for "spotting" street signs and house numbers, the Pittsburg Electric Specialties Company, Pittsburg, Penn., has designed and placed in the market a new searchlight. The light is unusual owing to the fact that its low current requirement of one ampere makes the ordinary dry battery a satisfactory source of current supply. It can, therefore, be used on a horse drawn vehicle as well as a motor vehicle.

The light has a powerful focussing lense in connection with an eight-inch parbolic reflector. The lamp is fitted with a bracket which is so constructed that it can be turned in any direction and at any angle for turning and backing the truck and for "spoting" house numbers and street signs. Detached from the bracket the lamp serves as a trouble light, and if used with dry cells constitutes an auxiliary and independent headlight system in event of the failure of the regular searchlights.

A one-story addition 70 by 176 feet to the plant of the Michigan Truck and Lumber Company at Holly, Mich., has been begun. In addition to doing contract work for the Ford Motor Company the concern has closed contracts with the Buick, Hudson and Maxwell companies of Detroit and the Chandler company of Cleveland.

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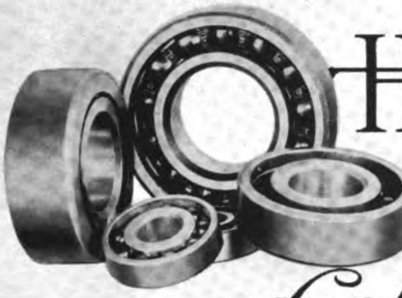

How Ball Bearings Are Tested for Quality, Precision and Endurance

Contributed by the Engineering Department, New Departure Manufacturing Company

THE average motorist or mechanic interested in the repair and operation of automobiles has little conception of the number of processes that the various components must go through before they are assembled to form the complete car. The modern automobile has only been made possible by careful and thorough refinement of the methods of manufacture which insure rigid maintenance to interchangeable standards and which facilitate the rapid assembling which is so essential to quantity production. The automobile manufacturer is fortunate in that he can obtain some of the units that comprise the assembly and which must be very accurately made from firms who specialize exclusively in these parts.

Anti-friction bearings of the ball type, which form an essential part of so many of the American automobiles and which are used almost to the exclusion of other types on the European cars, are made by specialists, who are equipped with machinery and processes adapted to the rapid production of work of great precision. When one speaks of fine work, one usually mentions watch work as an example, but in the manufacture of ball bearings many of the dimensions must be held to even closer limits than those prevailing in the highest grade watches. In order to maintain the strength and accuracy of parts it is necessary to not only test these parts during the various processes incidental to machining, but they must also be tested when assembled in the complete unit.

Fig. 1—How Brinnell Machine Is Used for Testing Hardness of Materials and Heat Treated Ball Bearing Components.

First Tests of Raw Materials.

The testing of ball bearings, therefore, starts when the raw materials are received at the factory and when the steel undergoes a chemical analysis to determine if it conforms to the specification desired by the maker. In line with these trials a sample is also subjected to heat treating and machining tests to determine the availability of the stock and to make sure that it is adequately annealed and that it will harden properly when machined. Take for example, a length of chrome steel tubing as received from the mill. Before this can be delivered to the machining department it is first tested for chemical composition, then for the physical characteristics, such as elastic limit, ultimate strength, elongation, etc.; then a specimen from the same bar must be heat treated and given further tests to determine the steel is suitable for the ball bearing parts. The testing of material, therefore, forms an important primary step in the processes incidental to ball bearing manufacture.

Next to this comes the testing of the parts as they are machined to make sure that they conform to the established dimensions, then the tests of the complete bearings before shipment to insure that these are uniform in quality, and finally extensive endurance tests

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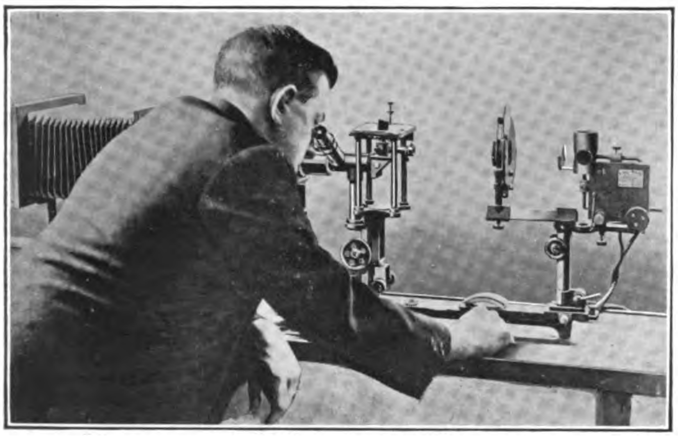

Fig. 2—Photo-Micrographic Apparatus Used for Examining Internal Structures of Steel as a Check Upon Physical Testing Methods.

of sample bearings from each lot to find out the resistance power of the bearings under conditions much more severe than those they are apt to meet in actual service. The chemical analysis of materials is a subject that is too broad in scope to be considered in an article of this nature which proposes to discuss briefly only the various machines that are used in making physical determinations or in checking measurements. The accompanying illustrations which were taken in the engineering laboratory of the New Departure Manufacturing Company at Bristol, Conn., are intended to convey graphically an idea of the forms of machines and instruments of precision necessary in making some of the most important ball bearing tests.

Testing for Machining Qualities.

The testing of material for machining qualities before heat treatment is made in two ways. The Brinell machine, which is shown at Fig. 1, determines the hardness of the material both before and after heat treatment, while the microscope shown at Fig. 2 is an occular check upon the results obtained with the physical testing machinery. The Brinell machine is a form in which a hardened steel ball is pressed into the work with a pressure that can be varied according to the material put to test. Steel is usually tested with a pressure of 3000 kilograms, which is easily attained with a very few strokes of the small hand pump mounted as a part of the large hydraulic cylinder. The ball is pressed in contact with the pieces to be tested for 15 seconds, then a small bypass valve at the top of the machine is opened and the pressure released. The width of the impression produced by the ball is measured with a delicate microscope with integral scale attachment and the result is checked off from a scale of standard equivalents which show the degree of hardness of the piece tested as expressed in terms suitable for comparison of pieces tested in the Brinell machine.

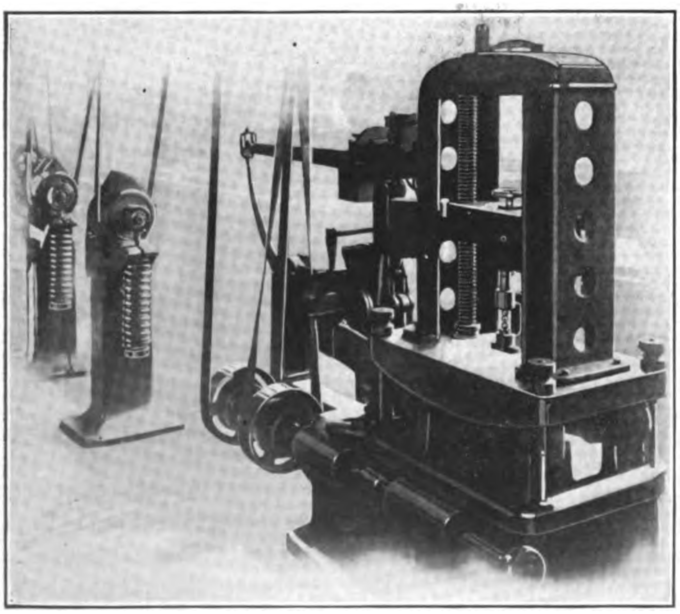

Fig. 3—Riehle Testing Machine Used for Determining Strength of Materials and Finished Ball Bearing Parts.

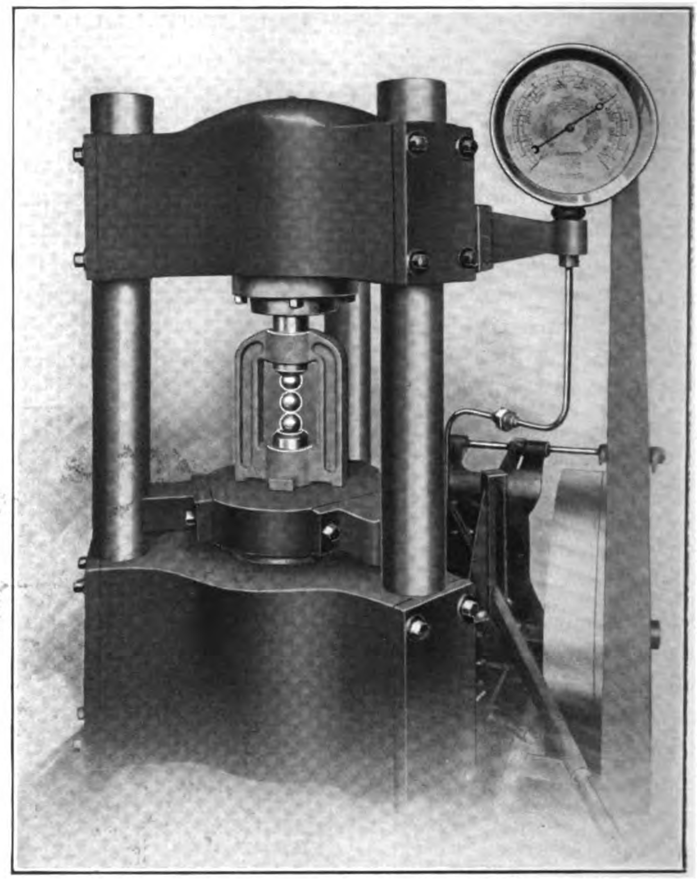

Fig. 4—Only Method of Crushing Large Alloy Steel Balls Is by Powerful Hydraulic Press That Will Exert Pressures up to 450,000 Pounds; by Placing Three Balls in Line This Enormous Load Is Concentrated on Two Points of Contact on the Middle Ball.

The harder the piece of material tested the less the width of the impression made by the steel ball.

Photo-Microscope Apparatus.

The photo-microscope apparatus is used to examine the internal micro-structure of steel to determine if it has been properly annealed, hardened or as the case may be. To one who is skilled in metallurgy the various structures which are magnified from 1000 to 2000 times tell the story as clearly as a page of printed type. Even the approximate chemical composition of the steel may be determined in this manner. To make physical tests of the material, which is, of course, essential both before and after heat treatment, the Riehle machine, shown at Fig. 3, or the hydraulic test-

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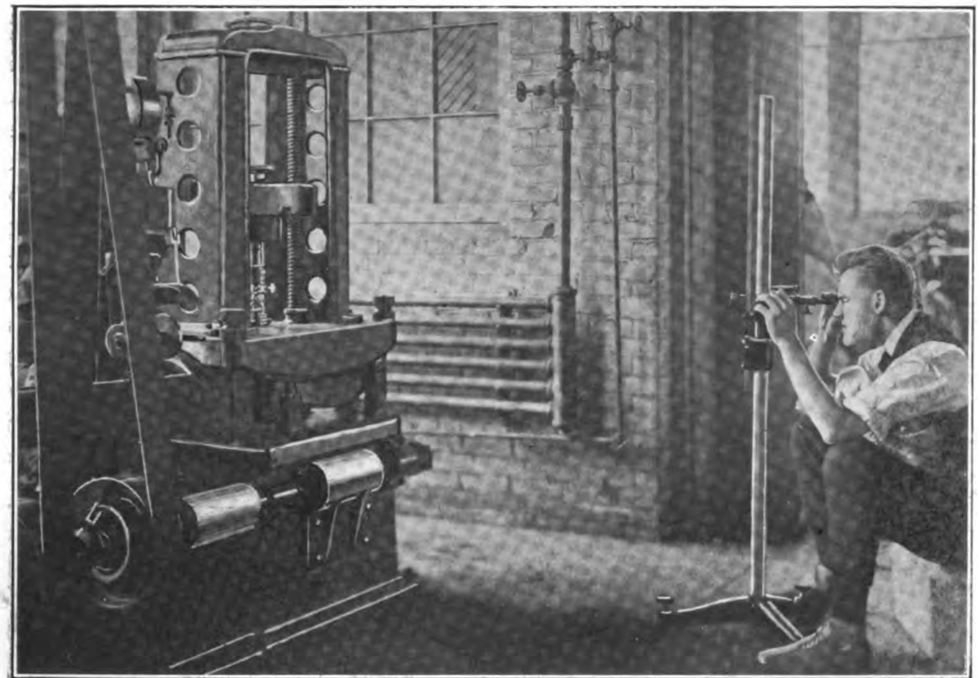

Fig. 5—How Apparatus Is Set Up for Testing Ball Elasticity, Which Is an Index of Recovery After Deformation.

ing machine, shown at Fig. 4, are used. The Riehle machine can be used for making tests of elastic limit or ultimate strength and can either pull the piece to be tested apart or compress it as the case may be.

As indicated in the illustration, the machine is used for breaking balls, three balls being placed in line in a special fixture. The hydraulic machine is also used for breaking balls that require so much pressure that the Riehle machine does not have sufficient capacity. In this case balls two inches in diameter are being crushed to determine the ultimate strength and the pressure gauge pointer indicates approximately the pressure at which these balls break. When breaking large steel balls it is necessary to put a substantial case of wood around the fixture to prevent flying particles from injuring the observer or spectators, as when the ball ruptures it usually breaks into many small pieces and with a loud report. These particles fly about the room if not restrained with almost the force that would be produced if they were shot from a gun and protection is necessary to insure the operator or bystander against injury.

Next to the testing of the raw materials, the determination of strength of finished components is an important part of the work. To show how accurately tests must be made a set-up of apparatus for testing the elasticity or the capacity of the steel balls to recover their form after distortion under load is shown at Fig. 5. This is an important test because elasticity of the material is an important quality of steel used in ball bearing manufacture.

As will be apparent, no materials are incompressible. Even alloy steel balls can be compressed, though great pressures are necessary to produce any appreciable deformation. An index of the quality of the steel ball and its adaptability for bearing work is the number of times a ball can be compressed without losing its true form when the pressure is released. When used in a bearing the load is always carried by more than one ball, but at the same time there is one ball immediately under the point where the load is applied that receives more stress than the other ones on either side in the loaded area of the bearing.

Though the compression may be imperceptible with ordinary instruments of measurement, the delicate apparatus illustrated at Fig. 5 shows even the most minute deflections in a positive manner. The

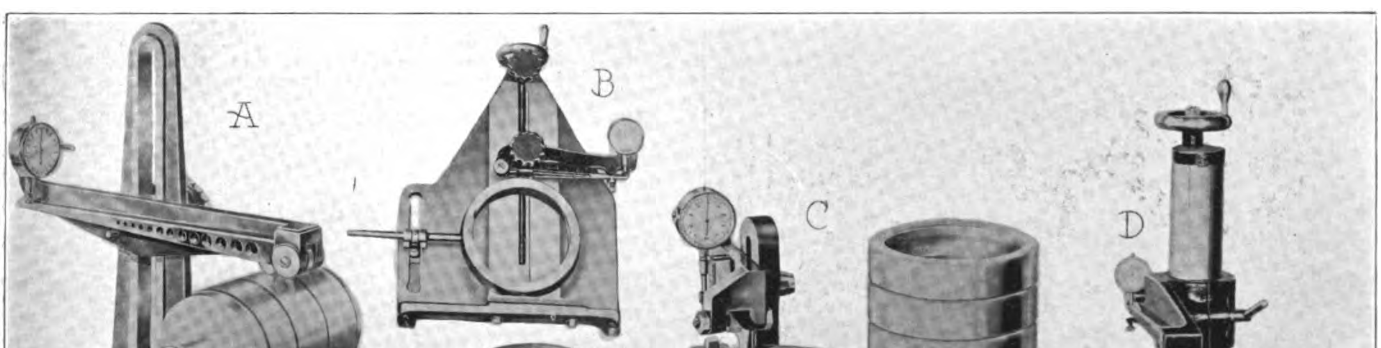

Fig. 6—How Dial Gauges Are Used in Connection with Multiplying Mechanism to Make Accurate Readings of Ball Bearing Dimensions Possible: A, Multiplying Gauge, Having 5 to 1 Increase, for Rough Ground Work; B, Multiplying Gauge, Having 10 to 1 Increase, for Finish Ground Work; C, Multiplying Indicator Gauge, Having 5 to 1 Increase, for Gauging Width of Cups and Cones; D, Multiplying Indicator for Testing Bearing Diameters, Having 10 to 1 Leverage.

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Fig. 7—Operator at Telescope Reads Deflection of Figures on Vertical Scale in Mirrors Attached to Balls Tested.

balls are placed in a special fixture, as shown at Fig. 9, three-in-line. Delicately pivoted mirrors are attached to the fixture and also bear against suitably formed projecting pivots soldered to the balls.

Any deflection of the balls will tend to rock the mirror. No matter how slight these deflections are, the mirror will be rocked to some extent. A long calibrated scale with large figures is mounted in line with the mirrors, with a strong light directed on it, so the figures on the scale are reflected in the mirrors. Two scales may be used and two mirrors or only one scale and one mirror.

The mirror is then examined through a telescope, which is a part of the scale carrying stand, as shown at Fig. 7, and the most minute deflection of the balls moves the mirror, which in turn shows a different set of figures when it is inclined than when it is parallel with the scale. It will be apparent that the further away the scale is placed from the mirror that greater leverages are secured and the most minute deflection can be easily read by variation of the reflected beam of light. For example, a difference of 10 graduations of the scale as reflected in the mirror may indicate an actual ball deflection of less than one-tenth of one thousandth of an inch. In order that the balls be suitable for bearings they must be capable of being deformed under pressure almost equal to their elastic limit for many times and yet always recover their

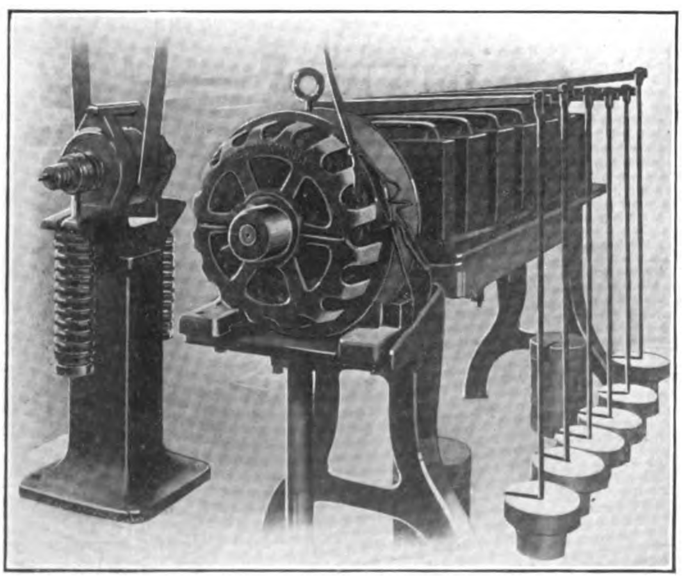

Fig. 8—Endurance Testing Machines for Proving Strength and Continued Resistance of Ball Bearings Under Big Overloads.

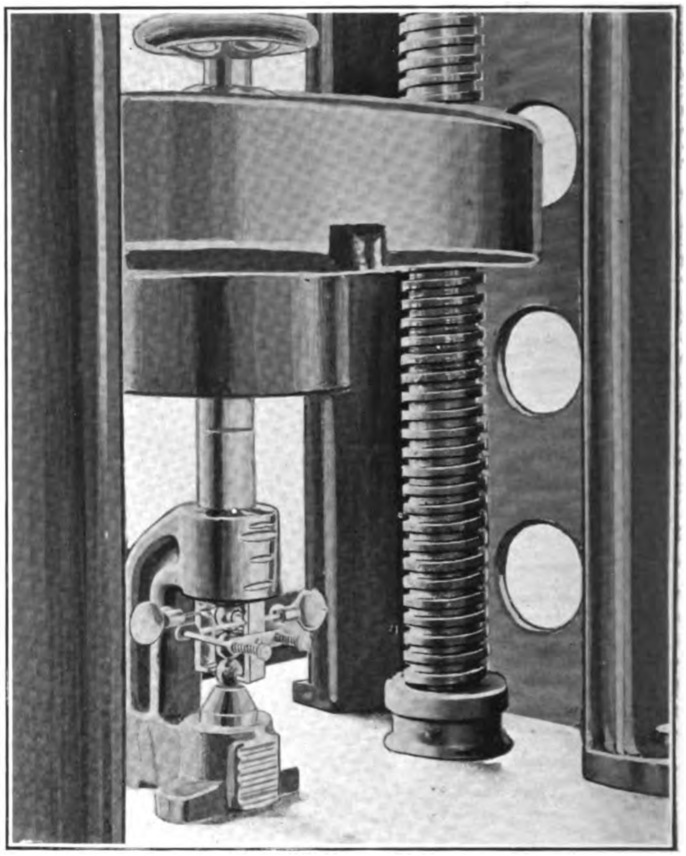

Fig. 9—Method of Mounting Balls and Attaching Mirrors in Special Testing Fixture Placed in Riehle Machine.

true form with an almost imperceptible permanent set, even when indicated by the very delicate apparatus described.

Next to the testing of material and machined parts before assembly in the complete bearing, it is important to determine the precision and accuracy of the parts themselves and also of the finished bearings. This is done throughout the manufacturing process by multiplying indicator gauges of great accuracy and yet of such a form that they may be easily read by mechanically inexperienced, though specially trained inspectors. In every case the dial indicator, which is of the form calibrated in thousandths of an inch, is mounted at the end of a long lever, which insures a multiplication in the reading of from five to 10 times and which will indicate on the dial gauge five to 10

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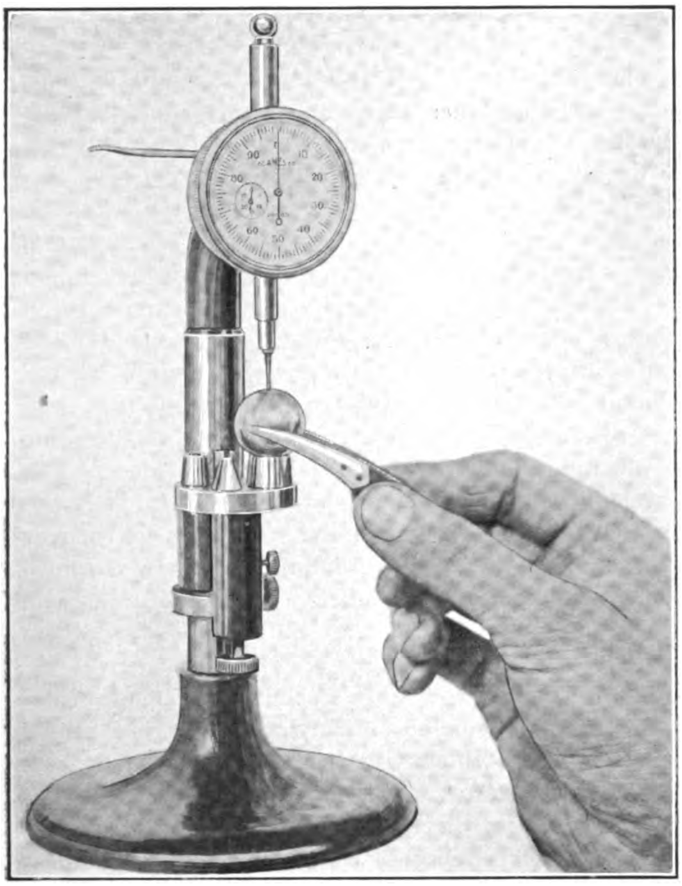

Fig. 10—How Delicate Dial Indicator Is Used to Test Steel Ball Size, One Graduation of the Dial Indicating 1/10,000 Inch.

times the actual error present in the piece. It will be apparent that with a leverage of 10 to one that a difference of one-tenth of a thousandth will be indicated by the movement of the needle to one graduation on the dial face, which can be easily read by anyone. It is possible to use dial indicators in connection with these gauges that will read in tenths of thousandths of an inch, which means that with a multiplication of 10 to one on the indicator, an error of one-tenth of a thousand will show us 10 graduations of the dial scale. These various gauges are shown grouped in Fig. 6.

In order to keep these multiplying gauges up to the point of accuracy necessary, it is important to supply master discs by which the gauges may be set. These discs are checked on a master measuring machine, which is really a large micrometer, which will indicate variations as small as 1/40 of one thousandth of an inch (.000025-inch). This machine is shown at Fig. 11.

The steel balls used in ball bearings are a part that must be extremely accurate in order that the load be distributed evenly on all of the balls in the bearings. Experience has demonstrated that the balls assembled into any bearing should not vary by more than one-tenth of one thousandth from each other in sphericity or size. The special dial indicator used for testing size and form of steel balls is shown at Fig. 10.

This is mounted on a standard carrying a series of accurately machined bed pieces in the form of cups in which the ball is placed when it is desired to measure it. The dial indicator used reads in tenths of thousands and as the graduations are separated by an appreciable space, it will be evident that a reading can be made directly of one-half of one-tenth of a thousandth (.00005-inch). So delicate is this instrument that whenever balls are tested they must be held in a pair of horn-tipped tweezers to prevent the heat of the hand being transmitted to the ball, causing this to expand sufficiently to produce a perceptible movement of the pointer.

Final Tests for Endurance.

Samples of each lot of the completed ball bearings, or after the various parts are assembled, must be tested for endurance. This is done on special machines of the form shown at Fig. 8. The one at the right which is driven by an independent electric motor, has a capacity for testing 18 bearings at a time. The loads are imposed on the bearings in this machine by a compound leverage, which multiplies the weight hung from the end of the long lever more than 100 times.

A group of high speed, belt driven testing machines which are capable of testing the bearings under both radial and end thrust loads, similar to the one shown at the left of the illustration, are also used. These machines revolve at speeds ranging from 2000 to 3600 revolutions per minute, and the bearings may be loaded by compressing the heavy coil springs acting on the housings or bearing cases, so that they must carry from three to five times their rated radial or thrust

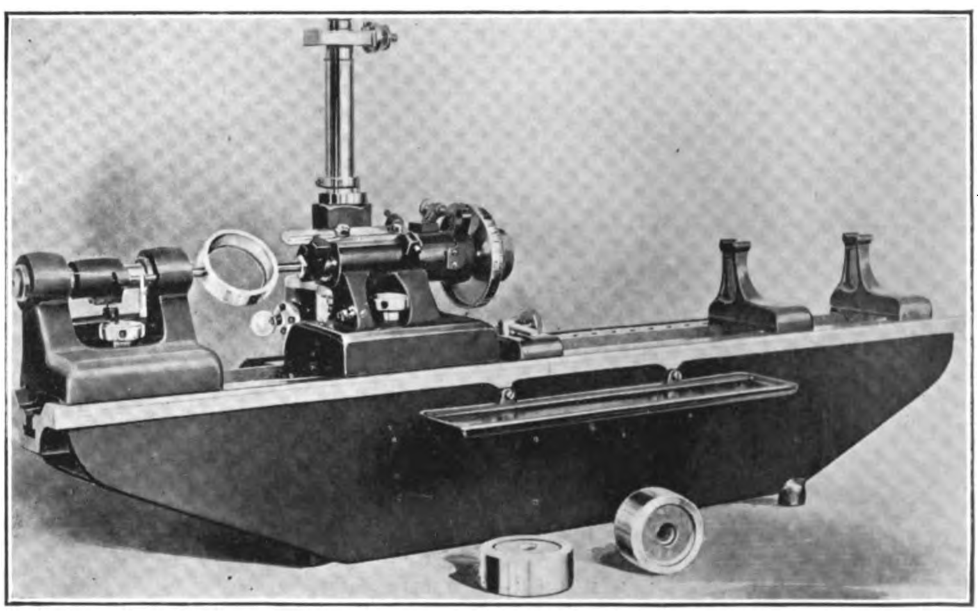

Fig. 11—Master Measuring Machine That Will Indicate Variations in Dimensions Less Than 1/100 the Thickness of the Finest Human Hair.

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load during the test.

The results obtained are expressed in tons—revolutions, which is a multiple of the weight of the bearings in tons times the number of revolutions covered during the life of the bearing. A definite minimum value has been set for each bearing size and if samples from any lot tested do not show an endurance equal to that established for that size, the bearings comprising the lot are not allowed to leave the factory. It will be evident, therefore, that ball bearings receive constant tests through every step of the manufacturing process, and even after they are finished. Careful attention to the various details insures the production of reliable anti-friction bearings, having uniform quality and maximum endurance.

NEW ONE-TON CHASE TRUCK.

According to report made the directors at the annual meeting of the Chase Motor Truck Company, Syracuse, N. Y., the company's business for the past year was 218 per cent. greater than in any preceding year, though not a truck was sold to any warring nation.

In view of the fact that eight of the company's 10 years in business was devoted to building two-cycle, air cooled wagons, the great increase of its sales of water cooled worm drive trucks is regarded as remarkable.

The company has announced a new model of one-ton worm drive truck. Up to this time the line has consisted of a 1500-pound truck, a 4000 pound truck and a 7000-pound truck. The new one-ton truck will sell for $1650. It has 140-inch wheelbase, 36 by 3½-inch front wheels and 36 by five-inch rear wheels.

The front axle is an I beam section. The rear axle is a Sheldon worm. The carburetor is a Holley. The engine is cooled by water. A Bosch high-tension magneto is used. The transmission gearset is Brown-Lipe selective sliding gear. Other constructional details include a dry plate clutch, semi-elliptic springs and a heavy hydraulic pressed steel frame. The weight of the truck on the rear axle is 53 per cent., while 83 per cent. of the pay load is carried on that axle. Electric lighting and starting equipment is furnished at extra cost. Deliveries of this model will be begun Dec. 1.

NEW STORAGE BATTERY PLANT.

A new storage battery plant is being erected in Indianapolis, Minn., by the Prest-O-Lite Company, Inc. It will add 45,000 feet to the present floor space. The building will cost $60,000 and the new equipment $25,000. It will be available for use Dec. 1. Storage battery service departments are being established at all the branches of the company.

A new factory for the Wichita Motor Truck Company, Wichita Falls, Tex., is being built in Dallas. No statement has been made whether the company is to remove its entire business to Dallas.

PEERLESS JOINS GENERAL VEHICLE.

The Peerless Truck and Motor Corporation has been formed and has taken over the business of the Peerless Motor Car Company and the General Vehicle Company, which is a subsidiary of the General Electric Company. Since 1912 the Peerless company has been controlled by the Terry, Tremaine and Crouse group of Cleveland capitalists, who developed the National Lamp Company, which manufactured about 60 per cent. of the incandescent lamps sold in the United States until the business was bought by the General Electric Company. This deal means that they have disposed of their motor car interests to the same people that took over their electrical business. The new company is capitalized at $15,000,000. It is understood that Peerless common stock was taken over for $175 in cash and $50 in bonds of the new corporation. Peerless preferred stock went for $105 in cash. Peerless common, which was selling as low as $10 in October, 1914, thus brought $225 to its owners.

There is to be no change in the management either of the General Vehicle Company or the Peerless Motor Car Company, which will be continued as separate subsidiary concerns. The control of both now rests with the General Electric group. The Peerless Motor Car Company is reported to be about to bring out a new eight-cylinder car, which will sell for between $1800 and $1900. A new two-ton truck will also be built. L. H. Kittredge, B. G. Tremaine and F. S. Terry will represent the Peerless wing of the company on the general board of directors.

LOCOMOBILE PROFITS LARGE.

The Locomobile Company of America is operating its truck shops night and day making motor trucks for European war service and statement is made that from 40 to 50 trucks are shipped each week. Estimating the average net profit for each truck at $1000, and the weekly shipments at 45 trucks, profits of $2,340,000 for the year are indicated on that branch of the business alone. In addition to war order business the company is said to be operating its passenger car department to capacity. It can produce approximately 1200 passenger cars yearly. It is said that the earnings from this source alone should pay the charges on the $2,176,000 of debenture bonds which the company has outstanding and leave a substantial balance for the $1,500,000 seven per cent. preferred and $4,750,800 common stock dividend. No dividends have been paid on the preferred stock since 1912, but it is not cumulative.

The United States Rubber Company has acquired the Lycoming Rubber Company's works at Williamsport, Penn., which is to be used as an overflow plant. It will produce in small quantities such rubber specialties as the main plants are too busy to turn out.

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THE "EXIDE" BATTERY FOR ELECTRIC VEHICLES.

Contributed by the Engineering Department, Electric Storage Battery Company.

OWING to the constantly increasing traffic congestion of the city streets, especially in and around railroad and marine terminals, the satisfactory handling of merchandise and freight is becoming a more difficult problem every day. The introduction of the electric vehicle has helped to relieve the trouble, and its more general use will unquestionably be one of the deciding factors in its solution.

The usefulness and reliability of an electric vehicle depends very largely upon the storage battery, as it furnishes the power which propels the car. As the conditions of service are extremely varied and sometimes severe, the battery must be dependable, durable and rugged. These conditions are all met in the "Exide," "Hycap-Exide," "Thin-Exide" and "Ironclad-Exide" batteries, made by the Electric Storage Battery Company of Philadelphia. The four types, too, with their characteristics offer a very wide range over which battery selection may be made.

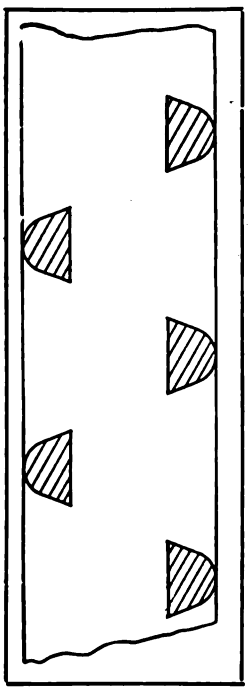

Fig. 1—Plate Section, Showing the Relation of the Ribs of the Grid.

The "Exide" battery was introduced in 1900, during the pioneer days of the electric vehicle, and it played a very important part in the successful growth of the electric vehicle industry.

The "Hycap-Exide" battery was put on the market in 1907; its essential details are the same as the "Exide" battery, but the plates are thinner, and a greater number can be used in the same space and for about the same weight as the "Exide," thus giving greater capacity for a given space and weight.

To meet cases requiring still greater capacity, the "Thin-Exide" battery, the plates of which are thinner than the "Hycap-Exide," was later developed.

The principal feature of the grids of these three types consists in having the active material held in the form of a pencil or ribbon between the horizontal ribs, which are staggered, in order to firmly lock the active material in place. The vertical ribs extend through from one face to the other, making the plate rigid, a property which is further secured by making the grid of a stiff lead alloy instead of pure lead. The construction of all the grids is the same except for the thickness and size of the ribs. A clearer understanding of them may be had from Fig. 1, which represents a section through the cross bars or ribs, showing their staggered relation.

The grids are "pasted" or filled with lead oxides, made into a paste of special composition, which sets hard in drying like cement.

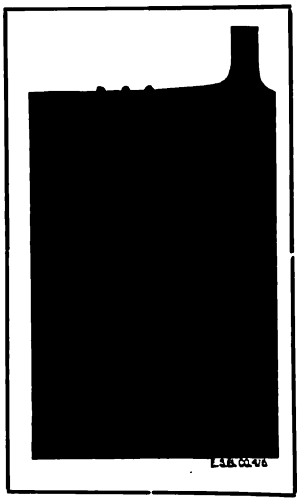

Fig. 2—The Finished Plate, the Vertical and Cross Members of the Grid Being Clearly Seen.

The plates then go through an electro-chemical process, which converts the active material of the positives into brown peroxide of lead, and that of the negatives into gray, spongy lead.

Fig. 2 will give an idea of the appearance of a finished plate.

The "Ironclad-Exide" positive, which was introduced early in 1911, has a grid consisting of a number of parallel, vertical lead alloy rods, united integrally to horizontal top and bottom frames. Each vertical rod forms a core, which is surrounded by a pencil of peroxide of lead; this in turn is enclosed by a hard rubber tube finely slitted. The slits serve to provide access for the electrolyte to the active material. They are so fine, however, as to practically eliminate the washing out of the active material.

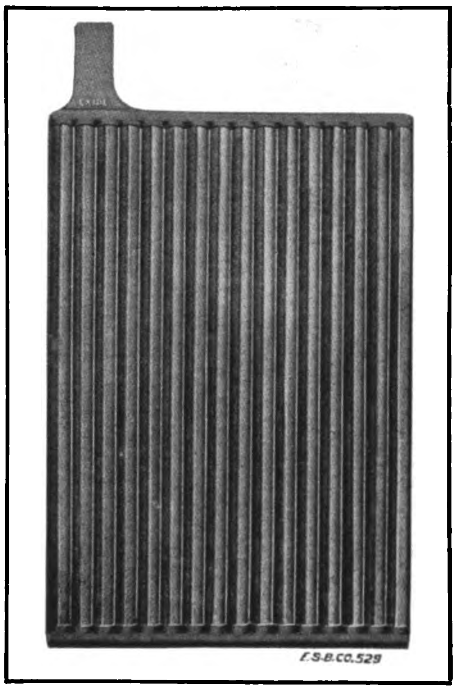

Fig. 3—The "Ironclad-Exide" Positive Plate, the Active Material Being Contained in the Tubes or Pencils.

Each tube is provided with two vertical ribs, projecting on opposite sides at right angles to the face of the plate. The ribs serve not only to stiffen the tubes, but also act as insulating spacers, taking the place of the ribs on the wood separators used in the other "Exide" batteries, and allowing the use of plain wood veneers. The tubes have sufficient elasticity to compensate for changes in volume of the active material due to expansion and

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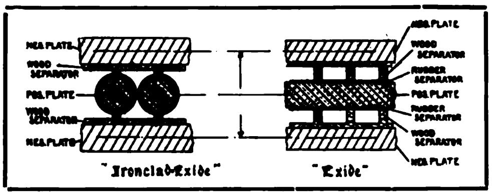

Fig. 4—Horizontal Sections Showing Positive Plate Construction.

contraction during charge and discharge.

Fig. 3 shows an "Ironclad-Exide positive plate.

The cylindrical form of the tube is well adapted to perform its function, since no amount of expansion or contraction will tend to alter its shape, and the internal strains are thus kept uniform. Another advantage is that most of the necessary electrolyte is carried within the confines of the plate itself.

This is illustrated in Fig. 4, showing a horizontal section of a portion of one positive plate with a separator and negative plate on each side, compared with a similar view of an "Exide" plate.

The "Ironclad-Exide" negative plate is of modified "Exide" form, the top and bottom edges being encased in rubber, vulcanized in place. This prevents material from bridging across to the positive plate and causing short circuits.

Fig. 5 will give an idea of the construction of an "Ironclad-Exide" cell, and Fig. 6 that of the other three "Exide" types.

The MV cell, the plates of which measure 5¾ inches by 8⅝ inches, is the one generally used in electric vehicle service. The thickness of the plates and the number in each cell vary with the service conditions to be met. The number of cells in a complete battery usually varies from 40 to 44.

The catalogue ratings of the MV plates are as follows:

MV "Exide"...........	7 amps. for 4	hrs. or 28	amp. hrs. per pos. plate
MV "Hycap-Exide". ..	5½ amps. for 5	hrs. or 27.5	amp. hrs. per pos. plate
MV "Thin-Exide".....	4.13 amps. for 6	hrs. or 24.78	amp. hrs. per pos. plate
MV "Ironclad-Exide" ..	7 amps. for 4½	hrs. or 31.5	amp. hrs. per pos. plate

The cells that may be used in this class of service vary in capacity from 48 ampere-hours to 370.5 ampere-hours at the normal discharge ratings shown above. This gives an idea of the wide range over which battery selection may be made.

To illustrate the different capacity results that may be obtained a jar 3½ inches long and 6⅛ inches wide contains nine MV "Exide" plates, 11 MV "Hycap-Exide" plates, 13 MV "Thin-Exide" plates or nine MV "Ironclad-Exide" plates, and the ratings of the cells are as follows:

MV-9 "Exide" 28	amps. for 4	hrs. or 112	amp. hrs.
MV-11 "Hycap-Exide" 27.5	amps. for 5	hrs. or 137.5	amp. hrs.
MV 13 "Thin-Exide"..24.75	amps. for 6	hrs. or 148.5	amp. hrs.
MV-9 "Ironclad-Exide" 28	amps. for 4.5	hrs. or 126	amp. hrs.

and the four cells have approximately the same weight.

Work of Plates Is Nearly Equal.

While the cells containing the thinner plates will do a greater amount of work per charge, the thin plates do not last for so many charges, that is, do not have so long a life as the thicker plates, but the total amount of work performed throughout the plate life is about the same for the three flat plate "Exide" types. The "Ironclad-Exide" plate, however, has from two to

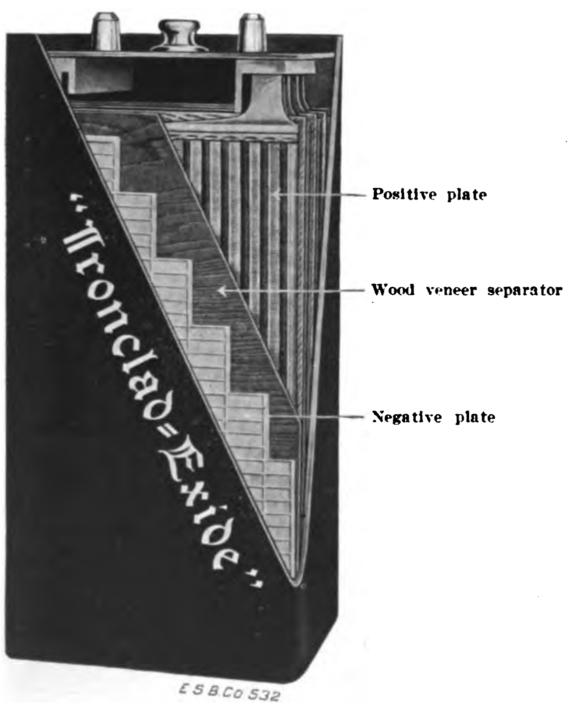

Fig. 5—"Ironclad-Exide" Cell, Cut Away to Show Assembly.

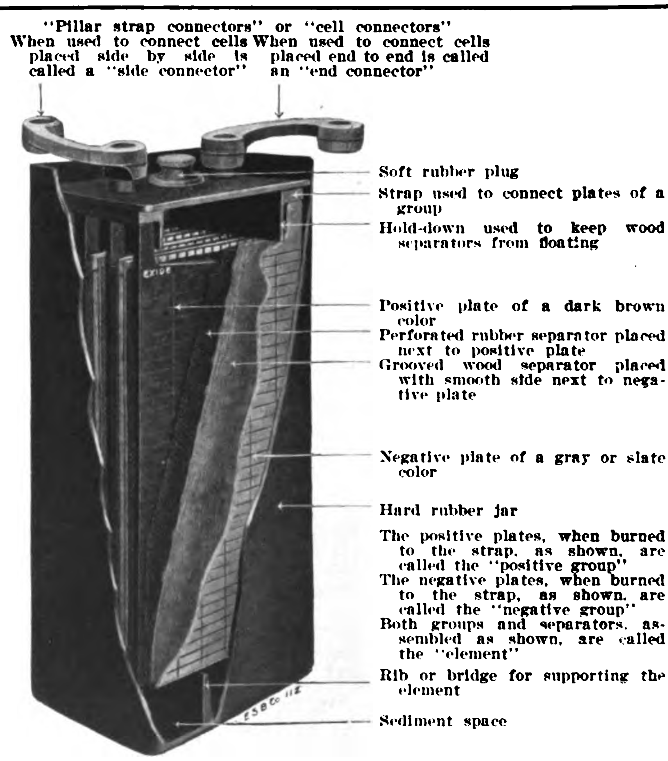

Fig. 6—"Exide" Cell, Showing Parts Used and Method of Assembly.

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three times the life of the other three and the amount of work it can do during its life is very much greater. The "Exide" plate is used when normal mileage per charge is required, the "Hycap-Exide" when the mileage per charge is in excess of that obtainable from the "Exide," and when maximum mileage per charge for a given battery space is needed the "Thin-Exide" is recommended. The "Ironclad-Exide" has approximately the same capacity for a given battery space as the "Hycap-Exide," and owing to its long life and other desirable characteristics, we unhesitatingly recommend it as being the most satisfactory and economical battery to install.

How Mileage May Be Increased.

When the service conditions are such that one battery charge is not sufficient for a day's work, two methods of securing greater capacity or mileage are followed. Either a fully charged battery is substituted for the one that has become exhausted, the change requiring from five to 10 minutes; or the battery may be "boosted" or charged at a high rate during the time the truck is standing idle.

It will be surprising to those who are unfamiliar with the subject to learn how readily "Exide" batteries lend themselves to "boosting," and to find that a fully discharged battery may be so boosted from a constant potential source for one hour as to do 50 per cent. more work; if boosted for 40 minutes, 38 per cent.; if for 20 minutes, 22 per cent. Expressed in terms of mileage this would mean that a vehicle after having gone 40 miles on a complete discharge would have its battery boosted as follows:

For 20 minutes to give 9 miles additional, a total of 49 miles
For 40 minutes to give 15 miles additional, a total of 55 miles
For one hour to give 20 miles additional, a total of 60 miles

The following table will show the available capacities after boosting with the battery in various states of discharge when the boosting charge is started:

Per Cent. Rated Capacity Discharged	Per Cent. Rated Capacity Available After Boost of 20 Minutes	40 Minutes	1 Hour
100	22	38	50
75	44	58	67
50	65	76	82
25	85	91	95

The manufacturer, on inquiry, will be glad to give further and full information regarding the details and results of boosting, as well as information regarding the care batteries should receive. They constantly hold themselves in readiness to render every possible assistance to battery users.

The four types of "Exide" battery, combining as they do, high voltage, great efficiency, low internal resistance and dependability, have given universal satisfaction and are being used as standard equipment by most of the electric vehicle manufacturers and large users.

It should lend confidence to electric vehicle users to learn that, in addition, the product of the Electric Storage Battery Company is being used by approximately 300 central stations in the country, by telephone and telegraph companies, by railroads for signal work, and for the operation of submarines and wireless apparatus, all of whom require batteries that can be depended upon at all times.

NEW INTERNAL GEAR DRIVEN TRUCKS.

Internal gear drive trucks equipped with valve-in the-head motors, to be known as the Superior, are being built by E. G. Willingham's Sons of Atlanta, Ga., for a southern market. The trucks have been specially designed for work in the South and sales effort will be concentrated there. The vehicles will be made in two models, one-ton and two-ton.

The one-ton chassis will sell for $1350. Both machines will be very much lighter than most trucks of similar capacity. They were designed by George Whiteside, for seven years in the engineering department of the E. R. Thomas Company of Buffalo, and was later with the American Locomotive Company. A new assembling plant, a three-story building, in which about 100 men will be employed, is being built by the company.

AHLBERG BEARING OPENS NEW BRANCH.

The Ahlberg Bearing Company, Chicago, Ill., announces that it has opened a branch at 926 Marquette avenue, Minneapolis, Minn., in charge of L. J. Bohan, who will handle the northwestern territory. The company now has branches in New York, Boston, Detroit, Cleveland, St. Louis, Los Angeles and Minneapolis. At these branches the customers' worn bearings are taken in and they receive reground bearings of any type at a cost of about one-fifth of a new one. Factories are located at Chicago and Los Angeles.

JOY ELECTED BY AERO CLUB.

Henry B. Joy, president of the Packard Motor Car Company of Detroit, has been elected a governor of the Aero Club of America. He accepted the position to enable him better to push his campaign for preparedness. He will take part in a movement to impress the government at Washington with the necessity of providing larger aerial fleets for the army and navy. It is stated that Mr. Joy has caused development work to be begun on a new multi-cylinder, V type aeroplane motor.

NEW MEMBERS OF N. A. C. C.

New companies which have joined the National Automobile Chamber of Commerce are the Denby Motor Truck Company, Detroit, Mich., and the Dort Motor Company of Flint, Mich., and the Millburn Wagon Company of Toledo, O.

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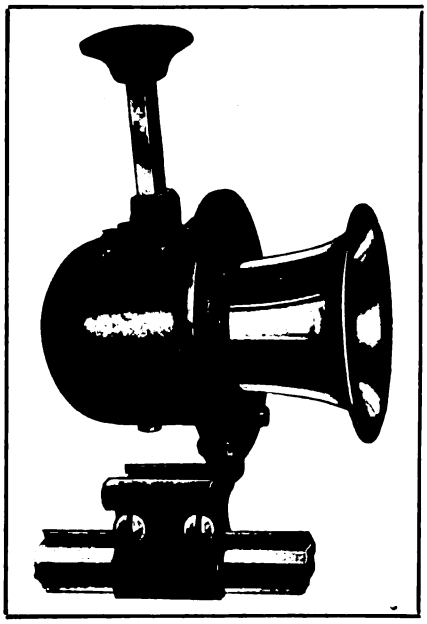
WARNING SIGNALS FOR MOTOR TRUCK SERVICE.

By P. J. FITZGERALD, the Fitzgerald Manufacturing Company.

PRACTICALLY every community of the country is studying the better regulation of vehicle traffic for the purpose of obviating known dangers and safeguarding the people generally. This is the result of accidents resulting from carelessness or negligence by drivers of animal and power vehicles and of pedestrians. There is no intention in this article of holding a brief for either the driver or the pedestrian, but to point out the possibilities from municipal or state requirement that all motor cars or trucks be equipped with such warning signal as will be distinctive and be positively understood by the public as a whole.

Street and highway traffic is increasing constantly. Few realize how great is this increase, even in small communities, and there is every reason to believe that this will continue in at least the same ratio of the past. The building of good highways attracts traffic to them and drivers will go longer distances on smooth surfaces than might be necessary were they to drive on rough streets and roads, which would necessarily result in greater fuel consumption and mechanical deterioration.



The Clero Mechanical Hand-Operated Horn, a Type Specially Adapted for Motor Truck Service.

Responsibility of Danger Warnings.

Wherever there is vehicle traffic there is danger. The laws require that horns or other means of signaling warn the public at all intersections of public travelled ways, and by common acceptance of custom one or more blasts of a horn is recognized as meeting this provision of the statutes. The law also assumes that there is at least an implied responsibility upon all motor vehicle drivers and all pedestrians to learn whether there is danger before moving forward or back, or turning in a highway, or leaving a sidewalk or crossing a street.

There is no doubt that this responsibility is shared, that is, the driver must protect the pedestrian by warning and by driving cautiously, while the pedestrian is required to satisfy himself that he will not be endangered. But while this is very generally understood and realized, thousands of avoidable accidents result from failure to judge speed and distance, from confusion, from impaired sight or hearing, from vision being obstructed, and, with children, from inability to realize danger.

No Intent to Cause Accidents.

No car or truck driver can be regarded as having deliberate criminal intention of injuring or killing another, and one cannot believe that people in possession of their faculties will deliberately invite injury or fatality, and for these reasons practically all accidents must be looked upon as misfortune resulting from circumstances that might be obviated with reasonable care, unless in the case of children, whose judgment may be said to be defective.

What has been stated may be applied generally, but there is more danger as a rule during daylight, because the traffic is quickly diminished after dark. One can understand that if the conditions that obtain during daylight were to continue at night there would be innumerable accidents. There is reason to believe, however, that there will be more night haulage each succeeding year and that the dangers from this form of traffic will so multiply that special attention will necessarily be given this condition to obtain better protection.

Horns a Satisfactory Warning Signal.

This is, of course, a very general statement relative to conditions that obtain, but there is one fact that must be considered by the owners and drivers of trucks, and that is the necessity of having signalling equipment that will be in every sense adequate. Custom has approved the horn for either pleasure car or truck purposes, much as bells have been universally adopted for bicycles, and there appears to be no reason why horns will not meet every requirement, provided that these can be so constructed that there will be no probability of failure and they will endure in hard service.

There are horns and horns, however. Three general types are used—those operated by pressure upon a rubber bulb, by turning or pressing a handle or lever, and by pressing a button actuating an electric circuit. The bulb horn has the merit of being cheap in cost, but bulbs must wear and fail, and the sound is extremely variable because the pressure is never twice alike. The usefulness of the electric horn depends upon the battery and the wiring. These horns are not usually truck equipment, because very few trucks have electric lighting and starting systems, special installations are expensive as compared with the mechanical horn, and they require systematic attention to insure operating efficiency.

Manually Operated Mechanical Horns.

The manually operated mechanical horn of which

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the Clero horns are highly perfected types, more nearly meets with the requirement of the truck driver and owner. First of all, such horns are comparatively inexpensive. They are absolutely dependable. The sound may be any volume desired, it being governed by the force exerted upon the handle or lever, and being a unit without connections of any kind, it may be located where it will always be instantly accessible and nothing can affect its efficiency. The construction of the mechanical horn is such that its operation is not affected by wear. It will endure for years if used practically continuously. It may be exposed to the weather, to dust and to the usual conditions of operation without deterioration. No adjustments are required. It may be mounted in any convenient place and in very small space.

The mechanical horn is a development from service experience and practically meets every quality that can be demanded in a warning signal. Simplicity has been sought to insure reliability and positive character of traffic signalling. It will afford tones that can be modulated for city driving or increased for use on country roads.

So far as the uses to be made of horns are concerned, there is no question that the public can be better served, but this would be a matter for regulation. By the adoption of a code of signals, the number of blasts signifying the intention of the driver, there would be a much better understanding and the safety of the public and vehicles could be much improved. Navigation is conducted by a universal code that is remarkably efficient, and there is apparently no reason why a system that could be learned in a few minutes should not be made a part of every motoring law. If such a system as has been suggested were required the benefit is apparent. The law could go further and specify different tones to differentiate the type of vehicle—that is, one for trucks and one for pleasure cars, if this were regarded as essential.

BUILDS BODIES BY THOUSAND.

The H. H. Babcock Company, Watertown, N. Y., is building commercial bodies for Ford chassis that are turned out in thousand lots. The bodies are made in eight different types to fit every requirement for service and are built from one standard body base by adding different units. The bodies are delivered painted and complete with all fittings ready to assemble.

To build a big order for tractors for the European nations at war, which is said to aggregate a million dollars, the Christie Tractor Company of Hoboken, N. J., has recently put on three shifts of men, each working eight hours.

The Ideal Wheel Company is to build steel wheels in a plant at Masillon, O. A building has been secured as a factory.

FEDERAL LETTER PRIZES AWARDED.

Prizes offered by the Federal Motor Truck Company, Detroit, Mich., to owners of Federal trucks who contributed letters on "Why I Bought a Federal," have been awarded after a careful consideration of 300 letters. The first prize of $100 went to F. F. Wedemyer of the Wamsutter-Slater Stage and Express Company of Baggs, Wyoming; second prize of $50 to Charles H. Plumb, wholesale grower of flowers of Detroit; third prize of $25 to the General Electric Company of Buffalo (central station), competed for by Advertising Manager Roy Crandall; 15 additional prizes of $10 each were awarded.

The object of the contest was to draw from owners their reasons for purchasing the better to guide salesmen in their appeals to prospects. For this purpose the company, after awarding the prizes, selected the factors that appeared to have had the most influence with purchases.

Repeat order advertising was shown to have made an impression; the character of Federal dealers was favorably considered by many buyers; thorough investigation of mechanical details by others showed the trucks to be exceptionally strong and well designed; that the machines seemingly have better and larger units than most other trucks of similar capacity, were some of the reasons for buying, which service facilities influenced a great many. Ability to serve a larger territory at less cost was a material factor, increased business caused many to buy, the failure of other trucks to make good turned some owners to Federal machines, and the advice of Federal truck owners in similar lines of business was beneficial. Heavy overload capacity when necessary proved attractive to some and the financial responsibility of the makers was of weight. Nearly every letter stated that the trucks written of had done more than had been expected of them when purchase was made.

WILL BUILD TRUCKS AND CARS.

Motor vehicles for both pleasure and business purposes are now marketed by the Rock Hill Buggy Company, Rock Hill, S. C., which has been making horse drawn vehicles for 30 years. This department of the business is to be known as the Anderson Motor Company and J. A. Anglada of New York has been retained as engineer. The first season's output is planned as 500 machines. The officers are J. G. Anderson, president; C. J. Henry, secretary and treasurer, and J. W. Anderson, manager. The pleasure car is to be known as the Anderson.

W. C. Kenney has joined the Hyatt Roller Bearing Company as chief mechanical inspector. He was associated with the Northway Motor and Manufacturing Company, Detroit, and previously was factory manager for the King Motor Car Company.

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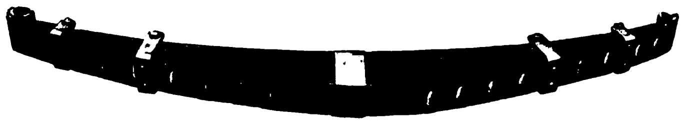
IMPORTANCE OF EQUALIZING TRUCK LOADS.

By MASON P. RUMNEY, Engineer Detroit Steel Products Company Automobile Spring Department.

IT IS the common opinion among people not familiar with the manufacture of springs, or their design, that springs are of standard types and kept in stock by manufacturers, and, therefore, when supplied for one make of trucks, can also be supplied to fit all of a similar type. This is entirely wrong. Every type of truck should have the springs especially constructed, as it is a matter of experiment and test to arrive at the best design.



Long, Flat, Flexible Springs Protect the Truck Against the Jars of Heavy Hauling.

Imagine the wear and tear on the mechanism of a truck equipped with improperly designed or carelessly made springs—springs that because of their misfit, act as conductors rather than absorbers of the shocks encountered on rough roads. The truck owner, because he does not know that the right kind of springs can be supplied at a slight additional cost over an inferior article, is apt to consider better grade springs as a luxury rather than a necessity.

Even the dealer may not fully appreciate the vast improvement that a slight additional investment will secure. Mistakes on the part of both owners and dealers, are made largely through ignorance of the real economy of good springs. If they realized that the superior qualities of good springs meant longer life to their trucks, greater safety to mechanism and load, and fewer maintenance worries, they would never again be satisfied with cheap springs even at a cheaper price.

Educating the Public to Good Springs.

Through national and direct advertising the makers of Detroit springs are endeavoring to give owners and dealers a better understanding of spring economy than they have had heretofore, and this effort naturally reflects to the advantage of truck manufacturers, who use good springs on their trucks.

People who buy and people who sell trucks are beginning to know and want good springs, and for this reason truck makers who use them will eventually find their product easier to sell. Moreover, good springs are as much of an economy to the builder of trucks as they are to the owner. By their use he saves the expense and trouble of replacing breakage and springs that have settled. Such accidents are more expensive to the manufacturer through loss of reputation than through the actual cost of the replacement.

A glance at the mechanical side of spring building reveals a host of little details which the owner, dealer and manufacturer will find it advantageous to keep in mind. For instance, in the worm drive and internal gear drive trucks the rear springs assume the office of torque arm, consequently taking drive and torque. If one of these springs should fail, a costly accident might occur, as they alone hold the axle in line.

It should be kept in mind that springs which are properly made and designed come down to a straight line under severe conditions. Clearances between the axle and the striking point should be large to allow ample deflections.

Long, Flat Spring Prevents Side Sway.

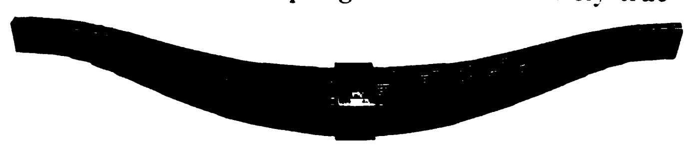
The best springs are long, low and flat, and should have ample width to prevent the side sway which causes excessive stresses in the material. They should be fastened to the axle by large sized clips, because breakage is apt to occur at this point if the spring leaves are not held tightly together. It is very desirable that the front springs should not be attached parallel to the road, but that the rear end be placed nearer the road than the front end. This sets the spring against the road and allows it to absorb part of the horizontal component of the road shock. If this is not done the road shock is transmitted lengthwise through the spring to the frame, giving a very disagreeable jar.

The reliable manufacturer considers all these points carefully in the equipping of every truck. In fact, these are only a few of the fine points required in springs that are properly designed for the burden to which they will be subjected.

The foundation of a well-made spring lies in the selection of proper material to meet the particular stress it will have to carry. When inferior material is used, rigidity and bulk are necessary because the low elastic limits will not permit of large deflections.

Machining an Important Factor.

Of next importance to the selection of good material is the machining of the different elements to make up a unit which will give the desired deflections on which so much depends. Every leaf should be of proper thickness and have a proper taper at the ends, and all should be held securely together at the centre after the final fitting of the individual leaves. The eyes in the end of the springs must be absolutely true and at right angles to the length of the spring. If these are not true, great wear will occur at one part of the eye and this will wear out the bushing or the



This Type Truck Spring Is Especially Strong and Efficient Because of the Large Number of Leaves, Heavy Centre Band and Oblong Lubricating Cups, Giving Perfect Inter-Leaf Lubrication.

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bolt and cause rattle in a very short time. It is also necessary that the width of the eye be faced to the exact size required. "Knocking" is thus prevented because there is no play between the shackles and the spring.

Form the Eye—If the Eye Is the Slightest Out of True Pressure on the Bolt Will Be Uneven, Causing Binding and Wear.

Perhaps the greatest difficulty, and the cause of the greatest trouble with springs, lies in improperly heat treating the material after all the machining and shaping operations are complete. It is very essential that steel be heated to an exact temperature before quenching, otherwise the different leaves have varying hardness of internal structure. It is most important that this structure be fine and fibrous, as the coarse structures are lacking in resisting qualities.

The Results of Heat Treating.

After the leaves have been hardened at the proper temperature, the temper is drawn back into the leaves to secure the proper toughness, and this also is a very delicate operation. The greatest care possible must be exercised in seeing that these heats are neither too high nor too low, for if the temper is drawn too much the spring will settle or take a permanent "set," while if it is not drawn enough, the springs will be too hard and will break.

Reaming the Eyes—Detroit Springs Are Reamed to .001 Inch and In Perfect Alignment with the Backs.

After each part has been thoroughly tested to see that the proper hardness exists, the leaves should be polished, so that when lubricated, they will slide readily on each other. If the leaves are allowed to bind a harsh action will result.

Spring lubrication is a problem in itself. Naturally it is important that a spring should be thoroughly lubricated at the friction points where the ends of each leaf work against the leaf adjoining. It is equally important that the centre of the spring, where there is no action, should not be lubricated. To accomplish this double result, various methods have been employed, the most successful being the self-lubricating device used on Detroit springs.

A small cup is stamped in each end of each spring leaf. This holds about a teaspoonful of long-lived lubricant, which the ordinary action of the springs works out over the leaves. These cups being situated at the friction points provide the necessary lubrication evenly and automatically, so that the harsh, squeaky action of dry springs is absolutely eliminated.

It is particularly important, therefore, that a motor spring should be "up to standard."

Keeping Springs "Up to Standard."

It is designed primarily as a protection against jars and jolts. More than that, the truck owner expects it to perform its service, and he drives accordingly. The failure of a spring at a critical moment removes this presupposed protection and frequently results in a serious accident, if not loss of life.

Therefore, when a spring maker says his product will answer certain specifications, it behooves him to see that it does answer them, and that is why, in most shops, every spring is severely tested before it is released for service.

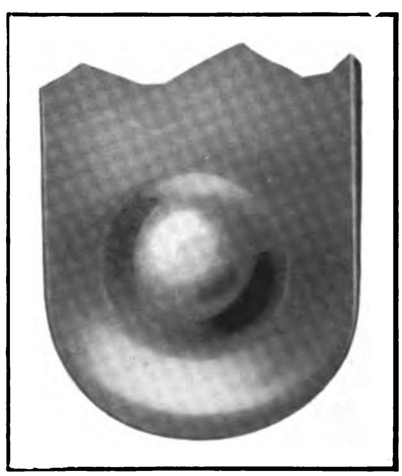
The initial test is made by assembling the leaves that are to be finally bound together into the finished spring and subjecting them all together to a load far in excess of anything they will be called upon to stand in actual service. Here are disclosed any defects in elasticity. If a spring passes this test, it can be depended on not to "settle" or break in active service.

Banding the Springs with a Hydraulic Press That Insures an Exact Process.

Some of the Tests Made.

A second test is made on the individual leaves when the spring is taken apart for polishing just prior to final assembling. Each leaf is taken separately and subjected to a load in a machine which indicates the hardness of the steel and texture of its grain. This test furnishes a double check against the heat treatment.

A third test, known as the "capacity test," is applied after the spring is finished. The spring is designed, of course, to carry a certain load at a certain height, so an indicator is set at the height intended and the exact load specified is applied. If the spring is depressed above or below the specified point, all previous operations and tests are counted zero.



Lubricating Cup Formed in the Ends of All Detroit Spring Leaves, Which Is Filled with Lubricant When Assembled.

But it must not be imagined that springs, however carefully constructed, will always remain in perfect condition without further care and attention. A certain responsibility devolves on the truck owner, if he

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expects his springs to give him maximum service. Occasionally the axle clips must be tightened, and the grease cups on the spring end bolts must be kept filled. Of course, the question of loading must be kept ever in mind—in fact it should be one of the big points considered when the truck is bought.

Let us suppose, for a moment, that we are in the market for a ton and a half truck. A truck manufacturer who handles only one-ton and two-ton trucks sells us either one or the other. Consequently, we either have a truck that is too light or too heavy for our purpose if our loads are to be uniformly about a ton and a half. In the first case we shall have an overloading of 50 per cent., and in the second place the truck will constantly travel 25 per cent. light. In either case the truck will be called on to withstand shocks that would not be present under proper loading conditions. In either case the results are bad. If the load is too great the springs will close up and allow the body to strike a dead blow against the axle. On the other hand, if the truck is too lightly loaded, the springs will not absorb the shock, but on the contrary, will transmit it to the truck and its load.

Buyer Depends on Springs.

Whether he knows it or not, the buyer of a truck depends upon the springs for assurance that his truck will run with regularity and constancy.

The storekeeper pays his money not merely to secure truck service for a single day. He could rent a truck far cheaper. He is willing to buy, because he feels safe in assuming that the truck will run regularly, day in and day out, at a cheaper rate than he would pay to rent one.

And this element of constancy is, in large measure, directly attributable to good springs and their protective qualities. They make it safe to rely on the motor vehicle as a steady performer.

When a motor truck stands the strain of constant travel week in and week out under all kinds of loads, over all kinds of roads, without repairs or overhauling, the owner knows that he is getting service and the economy of his investment begins to make an impression on him.

He finds his tires are going to last him all season, where Jones had to buy two extra ones a month ago.

He tells his friends about the rough usage he gives his truck and how his engine is running "just as sweet as ever."

Smith hears Brown, the grocer, constantly complaining about the delivery expense. Car always out of commission. Smith's trucks do not seem to give much trouble. He congratulates himself and he wonders why it is.

When Maintenance Cost Looms Big.

After a truck has been purchased, and the big initial expense fades somewhat out of mind, it is the maintenance cost that looms up big, because that keeps right on forever.

It is in the reduction of maintenance cost that the good springs give their most important service. All the bumps of the road are borne by the springs. Springs are bumpers that allow the owner to use and even abuse his truck without paying the penalty in "extras" and "repairs."

No engine or carburetor or starter or motor was ever built to perform its duty satisfactorily unless protected from the jolts and jars of travel. Without that protection the purchase price of a car or truck would be only a drop in the bucket compared to the repair and replacement bills.

Good Springs the Big Economy.

And if even crude springs are economy, it follows that good springs are more economical. They are more economical as protection to the truck. They are more economical, merely as springs, because, being better made they are less likely to break and require replacement. More than that, makers of good springs will generally replace, free, all springs that fail through defects of manufacture. This, of course, is an economy to the owner that poor springs cannot afford to carry.

Again, good springs mean tire economy, because a poorly made or improperly mounted spring fails to absorb the road bumps, and since tires are one of the most flexible portions of the vehicle, the duty of being a "bumper" is passed along to them.

The secret of securing maximum spring efficiency lies first of all in designing and building a spring adapted to meet the particular requirements of the truck on which it is mounted. But the designer and the manufacturer cannot do all—the truck owner himself must help. He must understand the conditions which the spring is intended to meet and see that the truck is so operated and loaded that these conditions will be maintained as nearly as possible.

GETS TRACTOR WAR ORDER.

A war order for a large number of Killen-Strait Manufacturing company's tractors, which are made at Appleton, Wis., and are equipped with 50-horsepower engines that will use either gasoline or kerosene, has been booked. The order calls for from 30 to 35 tractors a week and it will require the entire capacity of the Appleton plant for a year, though much of the work will also be let out to other plants.

William Strait, designer of the tractor, has been in Europe for four months and demonstrated the tractor on the field. He had tractors of four models with him for demonstration.

GARFORD TRUCKS TO SWEEP STREETS.

Commissioner Fetherston of the New York City street cleaning department, after his experience with Garford trucks used as street sweepers in the great snow storm of March last year, when as much work was done with trucks in 23 hours of continuous service as with horse drawn sweepers in 10 days, has announced that this year his department will hire a great many more Garfords for the same work.

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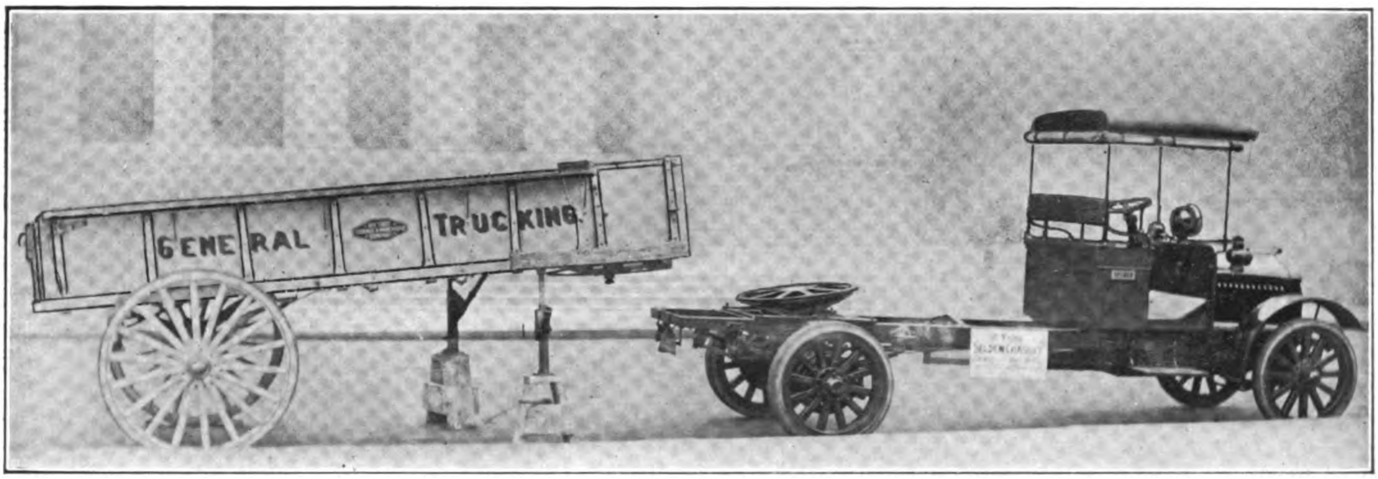
EFFICIENCY AND ECONOMY OF SEMI-TRAILERS.

By C. H. MARTIN.

ONE has only to glance at the pages of the magazines showing pictures of European army scenes to realize that the truck used as a tractor is with us to stay because it enables the truck to do a great deal more work than is possible when it only carries its normal load.

The question has been raised, "Is the conventional type of truck suitable for a tractor? Will it stand up under the increased load?"

It certainly is suitable and will stand up under the increased load provided the increase is drawn and not carried. The reason is very evident. When any motor vehicle is designed—pleasure car or truck—one vital thing considered in determining the size and strength of axles, frame, springs and tires is weight. Two vital things, however, are considered in determining the strength of the clutch, transmission, keys, shafting and all parts taking the driving strain. These two vital things are weight and the co-efficient of friction between the tire and the road. For example, we will say we are designing a five-ton capacity truck. We must make the parts which take the driving strain sufficiently strong to spin the wheels on the dry road when the machine is loaded to capacity and anchored so that it cannot go forward. If our tire is to be rubber, the parts must be stronger than if the tire were steel, for the reason that the co-efficient of friction between the rubber and the road is greater than between the steel and the road. Consequently, the resistance is greater. Weight and friction make the resistance.



Two-Ton Truck Equipped with Martin Rocking Fifth Wheel for Use with a Semi-Trailer Body of Four Tons Capacity, This Being Shown Detached and Elevated on Jacks.

The Haulage Capacity of a Truck.

If six tons were carried on the truck the resistance would be greater at the point of contact with the road than was provided for and consequently the gears might strip, the shafts twist, the keys shear, or some other part give way. If, however, we do not put any more weight on the truck than five tons, we can trail another five tons behind with perfect safety, because we do not increase the resistance at the point of contact with the road. The tractor method may be employed to draw 10 tons with much greater safety to the mechanism than if the truck itself were loaded with six tons.

Up to the present time the conventional type of motor truck shows a very narrow margin of profit when brought in competition with the horse. In fact, in order to show a profit at all, it must have long hauls, good road conditions, good facilities for loading and unloading. If it does not have these the horse can haul cheaper.

With any motor truck, one rule that applies to all machinery holds good. This rule is that unless the owner works the truck to its full capacity he is not getting his money's worth. Should he have a four-ton truck and haul only two tons on each trip, he is not using the truck to the full extent of its power and consequently is paying more for operation than he should. In other words, he is spending 75 cents or a dollar where he should spend but 50 cents. Exactly in the same position is the man who, with a two-ton truck and four tons to haul each trip, carries but the rated or normal load that his truck is built for. He can easily draw the desired four tons.

The question is how to utilize this truck as a tractor.

Two Methods of Tractor Haulage.

There are at present two methods employed. One is known as the semi-trailer method and the other the full trailer.

On account of the congested traffic conditions of cities, the best method is unquestionably that which is known as the semi-trailer. It is in reality a six-

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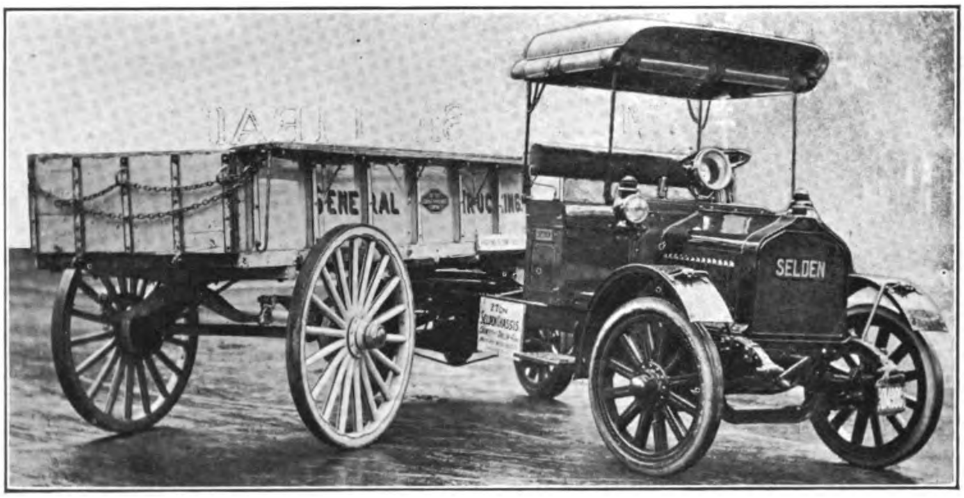


With This Equipment, Which Can Be Handled in Smaller Space and as Readily as a Horse Wagon, Work Can Be Done Anywhere.

wheel unit. It carries a part of the total weight on the driving wheels of the truck and the rest on two wheels trailing behind.

This method has many advantages over the full trailer.

It enables the driver to manipulate in narrow streets, driveways, lumber yards, coal yards and other places too narrow to allow the use of a four-wheel trailer.

Semi-Trailer Not Prohibited.

In many cities trucks with four-wheel trailers are prohibited, but the tractor semi-trailer is a unit and is allowed on all streets. With the tractor semi-trailer the driver can back the vehicle in exactly the same manner that a teamster backs a wagon with a team of horses. Backing is out of the question with the four-wheel trailer, except with some especially built trailers, and even with these it is necessary to have an extra man and special appliances, which occasion much delay.

The most important advantage over the four-wheel trailer method is that a part of the weight may be used for traction. If there is not enough weight on the driving wheels they will slip on muddy roads, asphalt, or on snow and ice. With the tractor semi-trailer enough weight is concentrated on the driving wheels to allow them to draw the entire load with no chance of slipping. This is not true of the four-wheel trailer.

Why Tractors Are Economical.

The reasons why the tractor principle is more economical and efficient than the conventional truck are many, one of the chief advantages being that the expensive part of the combination, the truck, may be kept busy all the time, for it can be used in connection with several wagons. While one wagon is on the road others can be loading or unloading. Thus none of the time of the truck or driver is wasted.

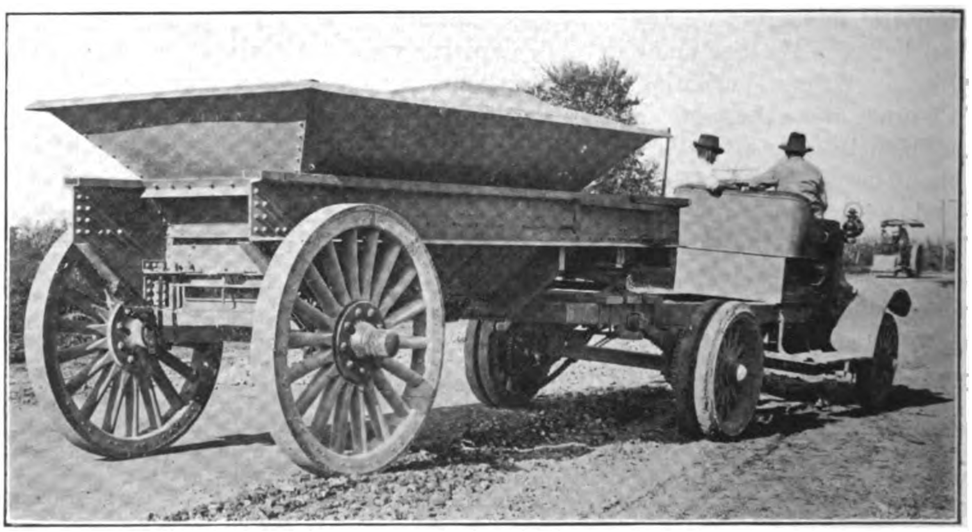
The truck is usually designed for one special use. A lumber truck can hardly be used to draw sand or crushed rock or a coal truck be used for lumber, but with the semi-trailer method the truck may be used to haul many different kinds of wagons—long wagons, short wagons, passenger 'buses, low bed wagons, end dump or bottom dump wagons.

Another big item making for economy is that half of the load or more is carried on steel tires. It is a well known fact that the greatest item of expense in the upkeep of any truck is the rubber tires and the tractor semi-trailer cuts that item right in two.

The tractor semi-trailer is very little longer than the conventional truck and it can be manipulated in the same space. A truck built with a short wheelbase for the express purpose of being used as a tractor can be manipulated in much less space, and can be backed square with the curb, which is often impossible with the motor truck in a narrow street or alley.

Weight of Load Not Necessary.

The weight per wheel is the same in the tractor-semi-trailer combination as in the conventional truck. In the latter most of the load is concentrated on the driving wheels, for there is no other place to put it, and the steering wheels carry the weight of the engine. In the tractor-semi-trailer combination the weight of the engine is still carried by the steering wheels, while the weight of the doubled load is divided between the driving wheels and the wheels of the trailer. Thus no pair of wheels carries more than in the conventional truck. For this reason the tractor-



A 3½-Ton Truck with a Bottom Dumping Trailer, Which Practically Doubles the Capacity of the Machine for All Kinds of Work.

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Knox Tractor with a Semi-Trailer Body Loaded with 10 Tons, This Being an Equipment Used by the Borden Milk Company, New York City.

was built to carry nor taken at a speed exceeding eight or 10 miles an hour. However, the best results may be obtained by building the trailers especially for their work, while following the same general design as the conventional horse drawn wagon—the only difference being that the springs, axles, wheels and tires should be made heavy enough to withstand the load that is put on them, and means should be employed to keep the wheels oiled.

As proof of the economy and efficiency of the semi-trailer a few examples may be cited.

W. K. Morse & Co., of Leominster, Mass., who do a general trucking business, are using a three-quarter-ton White truck as a tractor and have fitted up their regular wagons as semi-trailers. They are drawing from 6000 pounds to 8000 pounds at a load.

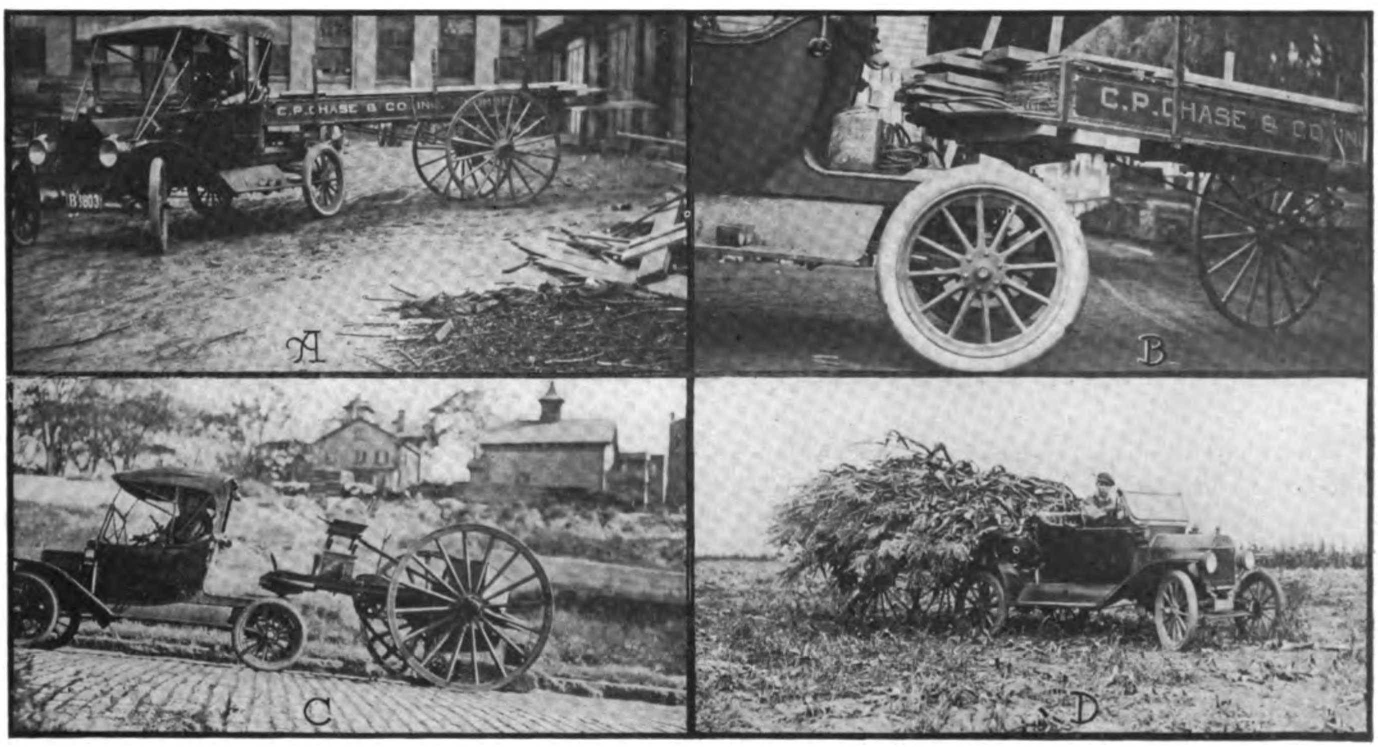
James Jones, who was formerly chief engineer of the Knox Automobile Company, is using a Ford car for a tractor on his farm. He draws from 1500 pounds to a ton and states that the cost is so small it can hardly be considered.

C. P. Chase & Co., lumber dealer, of Springfield, Mass., is using a Ford roadster as a tractor and one of its regular light spring lumber wagons as a semi-trailer. With this outfit it has replaced three one-horse wagons and states that it would easily do the work of

semi-trailer unit does no more damage to the roads than the truck which carries half as much.

Horse Wagons Will Endure in Service.

Motor truck salesmen, when the tractor idea was first advanced a few years ago, used as an argument in opposition (why the opposition is hard to understand) to the tractor that the wagons would not stand up at the speed that the truck would draw them. And this idea seems to have gained quite a foothold. It is hardly reasonable to suppose that a wagon built to carry five tons at three miles an hour, loaded with eight tons, and drawn at 12 miles an hour will stand up. But my experience, covering several years, has shown that a well built horse drawn wagon can be safely used as a trailer provided the bearings be kept oiled and the wagon be not loaded with more than it



Semi-Trailers in Practical Service: A, Light Roadster and Wagon That Replaced Three Horses and Wagons in Lumber Delivery; B, the Martin Rocking Fifth Wheel; C, Outfit That Does the Work of Two Teams and Two Sweepers Street Cleaning; D, Hauling Ton of Fodder Corn from the Field to the Ensilage Cutter.

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four. The company has no trouble drawing from three-fourths of a ton to a ton to any place.

The Kansas City branch manager for the Kelly-Springfield Motor Truck Company states that one of his customers is using a five-yard "Bull Dog" semi-trailer with his 3½-ton Kelly-Springfield truck. He hauls 20 cubic yards of rock a day a distance of 10 miles, which is the work of 14 teams and is eight cubic yards more than he was able to handle with the truck alone.

The Borden Condensed Milk Company of Brooklyn, N. Y., has now in use 34 Knox-Martin tractors, each tractor doing the work of three four-horse teams in the same service and with the same wagons—400 horses displaced, but the wagon equipment saved.

This company was one of the first to take up motor trucks, but after giving them a thorough tryout in comparison with horses had discontinued their use entirely and had for reasons of efficiency solely gone back to horses.

The company was reluctant to try the tractor plan, but was persuaded to take a demonstration. That it now has 34, each of which hauls 10 tons at a load, is sufficient proof that the tractor-semi-trailer is more efficient and economical than any other method of transporting merchandise on the highway.

BUILD TRUCKS FOR RUSSIA.

The Baldwin Locomotive Works, Philadelphia, Penn., intends to engage in the automobile and motor truck industry, from which the American Locomotive Company was withdrawn, according to reports at Eddystone, where 300 trucks for the Russian government are now being built. The company is building a 20-acre plant for the Remington Arms Company, which will be used for arms manufacture during the war, after which it is understood it will be permanently devoted to the automobile department of the company. The trucks being built for Russia are equipped with low steel wheels that have heavily ribbed rims to prevent skidding. These will be used to haul small trailers from railheads to the front, laden with supplies and munitions.

ANDERSON ROLLED GEAR PLANT SOLD.

The Shaw-Kendall Engineering Company of Toledo, O., has signed a contract to take over the plant of the Anderson Rolled Gear Company of Cleveland, O., and it will manufacture the patented gears controlled by the Cleveland company. The plant will be moved to Toledo and 1000 men are expected to be employed within a year.

The new plant of the Falls Rubber Company at Cuyahoga Falls, O., is now completely equipped with machinery and is ready for operation.

RAILROADS AFTER TRUCK LINE.

Another instance in which a motor truck line between cities has caused action to be taken by the railroads with which it competes has arisen in California, where the Western Association of Short Line Railroads has brought action before the California railroad commission to bring about the regulation of the Wichita Transportation Company, which operates a freight and passenger truck line between San Diego and Imperial valley.

The complaint declares that the line carries freight and passengers and is therefore a common carrier, subject to the public utilities act. It maintains that the company has failed to register under the act and is therefore liable to penalties provided for that omission. The complaint further states that the line subjects the short line roads to prejudice and disadvantage and has caused them irreparable loss by reason of an unreasonable difference in fares and charges.

This is the second line of trucks that has competed with railroads so effectively as to cause appeal for aid to the railroad commissions. The other instance was in the case of a short line railroad in Kentucky, which asked leave of the Interstate Commerce Commission to reduce its rates.

NEW FORD TRUCK CHASSIS.

The Jewett Car Company of Newark, O., has begun the manufacture of one-ton trucks of which the Ford passenger car chassis is the basis. The truck is made up of the front part of the Ford chassis, with the engine mounted in a sub-frame and an internal gear drive rear axle. The rear construction is heavy and arranged to carry 90 per cent. of the truck load.

This machine will, so claim is made, carry its load 18 miles on a gallon of gasoline and can be operated at approximately 1½ cents a mile. The chassis is sold for $800 and bodies of various types can be supplied at an average cost of about $50. A. P. Hess of the Hess Auto Company, Newark, O., has undertaken the marketing of the truck.

FEDERAL TRUCK HAULS SAND CHEAPLY.

A Federal truck operating in Atlantic City, N. J., recently made a record of delivering 136,800 pounds, or 68.4 tons of sand, in 11 minutes less than five hours—at a cost of only a little more than eight cents a ton. The total cost of the work, including every item that could be charged to truck operation was $5.69. A special loading device put on the loads in 3.3 minutes on an average and they were discharged quickly by the use of a power dump body.

Keeler Brass Company of Grand Rapids, Mich., who make automobile hardware, are beginning the construction of a large addition to their plant.

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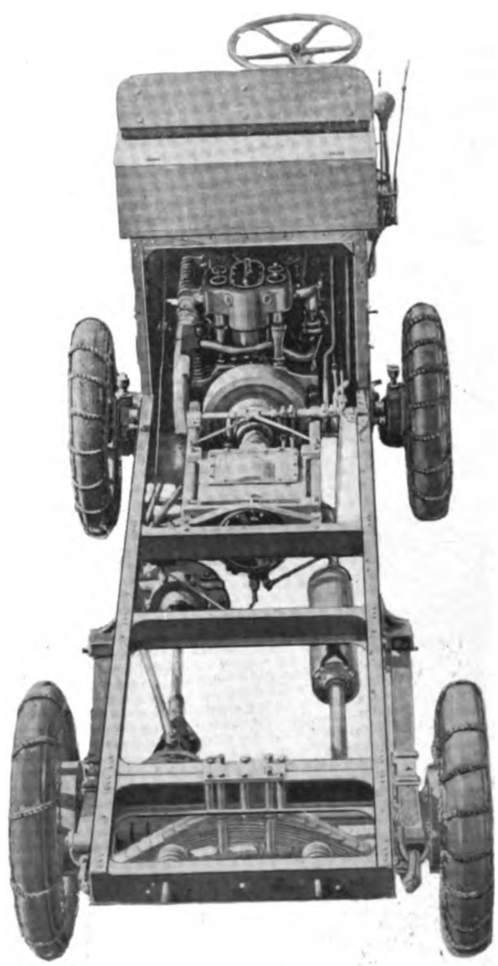
THREE SIZES OF FOUR WHEEL DRIVE TRUCKS.

Simplicity of Construction, Full-Floating Front Axle and Sub-Transmission Gearset Features of Machines Proven to Be Remarkably Enduring and Economical.

EXTREME operating economy and efficiency have been the purposes sought by the engineers who have developed the Four Wheel Drive trucks, built by the Four Wheel Drive Auto Company, Clintonville, Wis., which are claimed by the manufacturer to be one of the highest perfected machines produced by the American motor vehicle industry. The statement is based on service experience. These trucks have been constructed for more than seven years, all are still in service and not one has as yet been regarded as having reached the end of its usefulness. In fact, there is reason to believe that the first vehicles turned out by the company be economically serviceable for several years more, so that what is ordinarily recognized as service life has in every instance been considerably exceeded.

These trucks, as the name implies, are driven by all four wheels, the power being created by a four-cylinder engine, but the driving system, or the power transmission system, differs materially from that of any other machine built in America, and perhaps in the world. This system is conventional from the engine to the gearset, but instead of the shafts being continued to the front and rear axles direct, there is a line of shafting from the gearset forward and back that parallels the line of the main shaft. This is driven by a silent chain from the gearset. The sprockets on the main shaft of the gearset and the parallel shaft drive what is termed a sub-transmission, the sprocket of the parallel shaft enclosing a differential gearset that compensates the difference in the movement of the forward and rear wheels.

The rear axle is a full-floating type that does not differ from conventional construction, but the forward axle, which is also full-floating, has ball and socket connections for the wheel spindles instead of the usual yoke and pivot knuckles, and the wheels are driven by shafts that have universal joints that coincide in horizontal movement with the sleeves on which the wheels are mounted. Both these constructional features are unusually interesting mechanically, for they are very carefully designed and perfected, and in many other details the machines differ from what may be regarded as standard practise.



The Stripped Chassis of a Four Wheel Drive Truck, Showing the Driving System.

Construction Much Simplified.

The trucks are extremely simplified and very accessible for work or adjustment, and no special tools are necessary for maintaining or adjusting them. The design has been standardized and there is a degree of interchangeability that is not equalled by any other machine built. For instance, the wheels can be used equally well on either the front or the rear axles, and should there be need for replacing worn parts, this can, in most instances, be done by the renewal of bushings and new bolts and pins, so that the expense of restoration is confined very largely to these, and the larger and more costly parts are seldom required unless in the event of accident. Another very important detail of the construction is the provision made for lubrication, there being means for thoroughly lubricating every wearing part, while all bearings surfaces are extremely large.

All parts of the trucks are built in the works of the company, aside from the motors, which are specially designed and constructed by the Wisconsin Motor Manufacturing Company, Milwaukee, Wis., one of the best known and most progressive engine building concerns in America. While every principle of engine construction accords with the most advanced practise, very careful provision has been made to insure adequate cooling, thorough lubrication, and the bearings and wearing parts are unusually large size to obtain long endurance and extreme operating economy.

General Description of Engine.

The following description is of the engine used for the three-ton truck chassis: It is a vertical, four-cylinder, water cooled, T head type, with the cylinders cast in pairs from a superior quality of gray iron, the valve chambers, water jacket and cylinder heads being integral. The cylinders and valve passages are entirely

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Demonstration of the Power of a Four Wheel Drive Truck Hub-Deep in Loose Sand in Which Traction Seemed Impossible.

The valve tappets are large diameter hardened steel rods that are case hardened and are fitted with adjusting screws and nuts. The rollers and pins are hardened tool steel. The guides are phosphor bronze that are secured in the crank case by studs and lock washers. The valves and springs are enclosed by aluminum housings. The housings are split in the centres and are retained by easily removable springs. The valves are 3½ per cent. nickel steel that operate in cast iron guides. The springs are held by beveled split bushings.

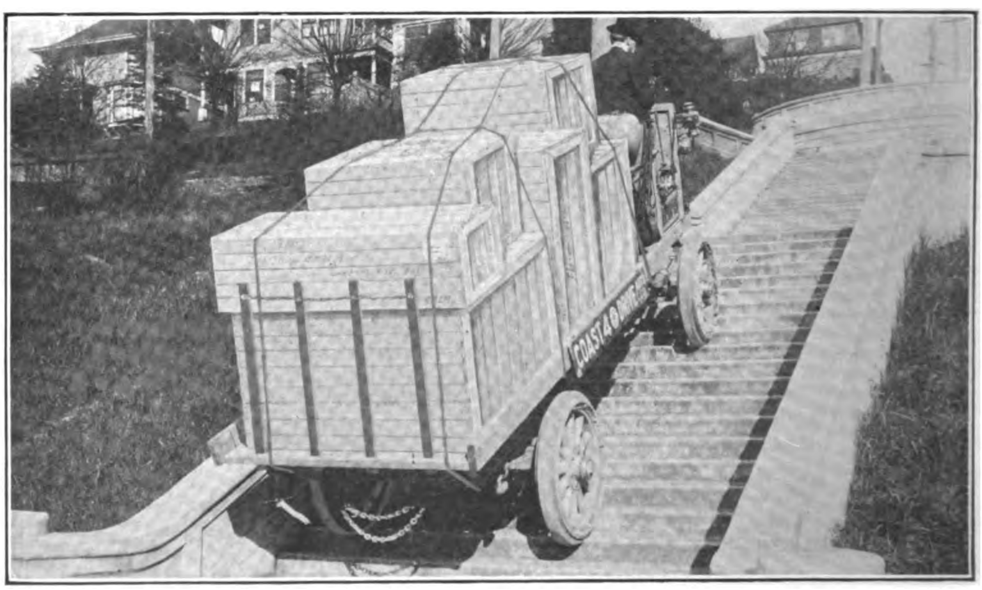
water jacketed and the water inlet is directly under the exhaust valves. The cylinder head plates are bronze, and in them are formed the water outlets. All castings are carefully cleaned and pickled before machining. The units are first bored, then reamed and after annealing are ground to size. They are subjected to high hydraulic pressure to insure against leaks or imperfections.

The pistons are made of the same grade of metal, and after pickling they are turned and ground to exact size. They are slightly taper, there being an allowance of .003 inch for expansion. The wristpin lugs are strengthened by webs. Each piston is fitted with three semi-steel compression rings and has four oil grooves, and a wide groove is cut into the piston in line with the wristpin, which collects the oil and leads it to the wristpin bearings. The wristpins are hollow steel tube, carefully ground and hardened, and are clamped to the connecting rods by bolts.

The connecting rods are I sections of drop forged, heat treated, 40 carbon steel, that are fitted with babbitt lined bronze bushings for the big ends. The caps are secured with four chrome vanadium steel bolts. The crankshaft is drop forged from chrome nickel steel, having a tensile strength of 120,000 pounds to the square inch. These are pickled and ground accurately to size and heat treated. The flywheel flange is forged integral with the shaft. and there are flanges at either side of the rear main bearing to take end thrust. The camshafts are 40 carbon steel drop forgings, with the cams integral. The cams are machined, heat treated and hardened and ground to master cams.

The crank case is in two sections, the upper portion being a special aluminum alloy casting that is reinforced by cross ribs. There are breathers at either end that are located close to the oil gauge, and with these the oil supply is replenished. The main bearings are supported by heavy webs that extend the entire depth of the case. The bearings are retained by through bolts and are entirely independent of the lower section. The hold-down bolts for the cylinder units are supplied with collars that hold them in place, so that the cylinders may be removed without taking off the lower section of the crank case.

All the timing gears are enclosed in an oil-tight case by an easily removable cover plate. From the forward end of the crank case the camshafts and the idler and water pump and magneto gears may be removed. The lower half of the crank case is the oil reservoir and is cast aluminum. There is an outlet plug for drainage. The timing gears are helical cut and have wide faces. They are lubricated by a duct bored through the idler shaft and a duct leading di-



Loaded Four Wheel Drive Truck Climbing a Long Flight of Steps to Demonstrate Its Tractive Power.

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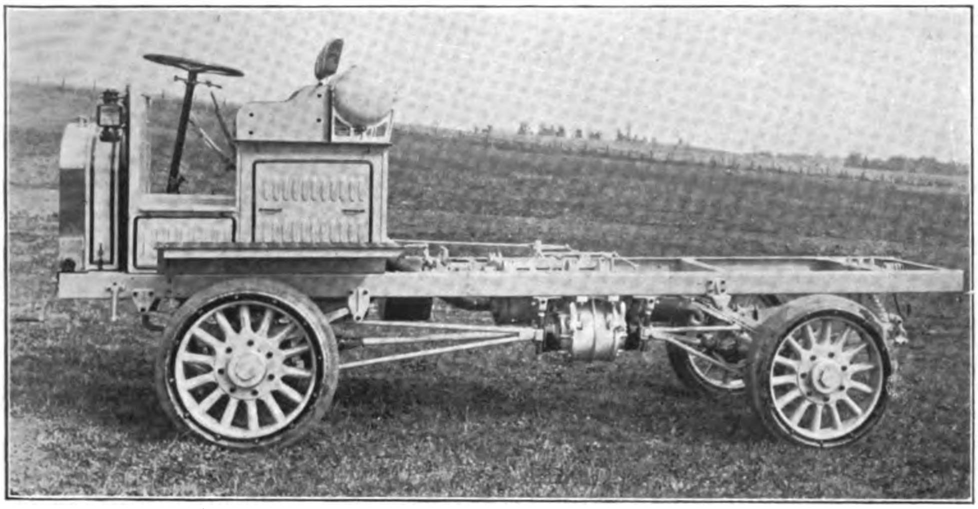


A Stripped Four Wheel Drive Chassis, Showing the Long Loading Space Back of the Driver's Seat.

main duct integral with the crank case and thence through ducts cast in the webs to the main bearings. Thence it is carried through the hollow crankshaft to the connecting rod bearings, each bearing being flooded. The oil thrown off from the connecting rod bearings sufficiently lubricates the valve tappets, the camshafts, the cams, the cylinder and piston walls. There is a screen to filter the oil as it is drawn into the pump. There is a ball and float oil gauge that indicates the supply available in the reservoir.

rectly to the oil pump. The gears are semi-steel, machine steel and drop forged carbon steel.

All the main and connecting rod bearings are bronze cages, lined with Fahrig metal, which are cut with grooves to insure lubrication. All the other bearings are phosphor bronze and are fitted with oil pockets and grooves. The bearings are ample in size. The crankshaft and connecting rod bearings are fitted with copper shims. The bearings are broached to size and carefully scraped.

The Cooling and Lubricating Systems.

The engine is cooled by a circulation of water through the jackets and a Candler honeycomb radiator of special design. The water inlet and outlet manifolds are solid castings, with no open joints that are held by studs and lock washers, the joints being fitted with "permanite" gaskets. The pipes are carefully proportioned to insure the certain volume of flowage. The water pump is bronze. Radiation is promoted by a fan mounted on a ball bearing on an adjustable bracket that is driven by a flat belt from a pulley on the water pump shaft. The radiator is built with a base of a solid piece of brass that has two pivoted arms that are carried in bearings secured to the frame. There is a third bearing at the top that is fitted with a spring so that the radiator may move freely, it being practically supported at three points. The shell of the radiator is tinned, brass polished, riveted and soldered. There is a large drainage plug, which can be reached without getting under the chassis. The capacity of the cooling system is seven gallons.

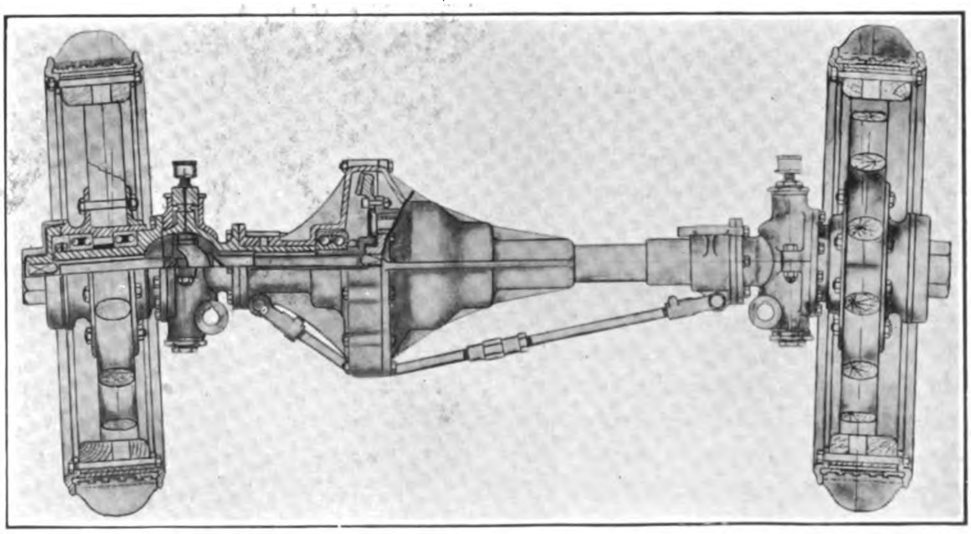
The engine is lubricated by a gear pump located on the outside of the lower section of the engine case, that is driven by spiral gears from the camshaft. The oil is forced to a

The fuel is supplied through a Stromberg model G double-jet carburetor that is not water jacketed. It is an automatic float feed type that can be very accurately adjusted for all operating conditions. The ignition is by a high-tension magneto that is driven by a separate gear and shaft through an Oldham coupling. The magneto seat is adaptable to any make of magneto.

The Evans Multiple Disc Clutch.

The clutch is the Evans multiple disc construction, which is the American built Hele-Shaw type, this having 23 alternating copper and steel discs that are operated in a bath of oil. This clutch is very easy in engaging, transmits the power without slipping, all parts are interchangeable, and being completely enclosed there is very little wear and adjustment is rarely necessary. Extremely high efficiency is claimed for this clutch.

The clutch shaft is coupled to the main shaft of the transmission system gearset by a universal or alignment joint that obviates possibility of thrust or side pressure on the shaft, caused by chassis distortion. The gearset is built with the main shaft above and the countershaft below, and the gears are always in mesh,



Sectional Sketch of the Full-Floating Front Axle That Is an Exclusive Feature of the Four Wheel Drive Trucks.

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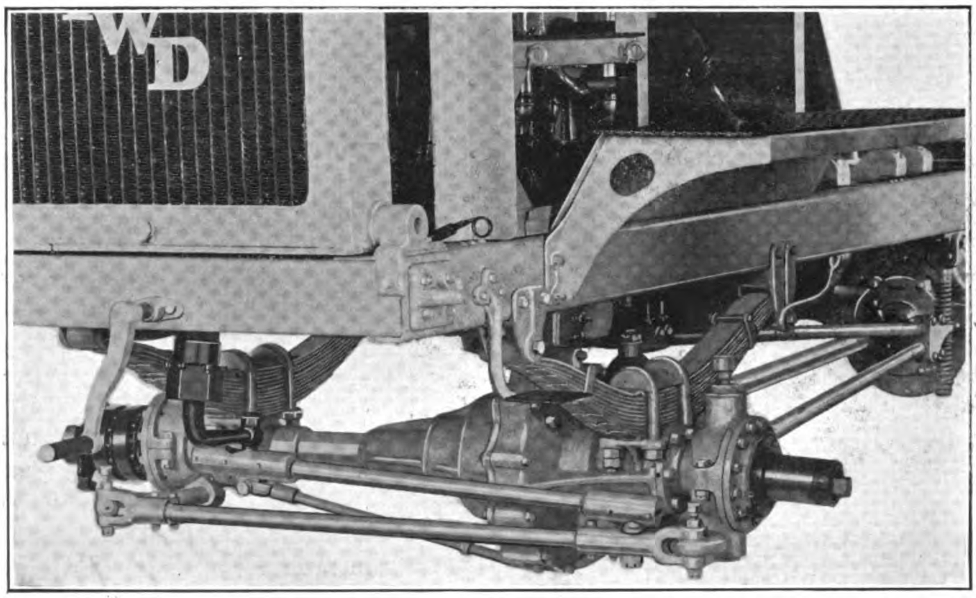


Four Wheel Drive Front Axle with a Wheel Removed to Show the Ball and Socketed Sleeve That Carries the Load.

engagement being made through a series of dog clutches on the main shaft. The main shaft is extended back of the gearset proper and this extension carries a sprocket for a silent chain.

The Sub-Transmission Gearset.

From this main shaft sprocket the silent chain extends to a larger sprocket mounted on a second shaft, the sprocket gear encircling the differential gearset. While the main transmission gearset and the sub-transmission gearset are assembled in a single case, this is so designed that the two gearsets are separated by an oil tight web or partition. The shaft carrying the differential gearset of the sub-transmission is coupled at either end by universal joints with the propeller or driving shafts that extend to the front and rear axles. These couplings are made with telescoping or slip joints, so that there is no possibility of end thrust upon the gearset because of the deflexion of the springs from load or road shocks, and similar universal joints and slip couplings are made at the pinion shafts at the ends of the driving shafts, which mesh with the bevel master gears of the differential gearsets in the full floating front and rear axles.

The sub-transmission gearset case is offset from the transmission gearset case, being at the left side, as the installation is made in the chassis. The reason for this offset is to obtain sufficient road clearance, the case being away from the centre, and as the driving shafts are coupled to the sub-transmission shaft, these are carried to differential gearsets at the left sides of the axles. One of the characteristics of the gear set of the sub-transmission is a differential lock. This is a dog clutch that is operated by a short hand lever. When the lever is set the differential gearset will not function, so that the driving power is distributed equally to both the forward and the rear axles.

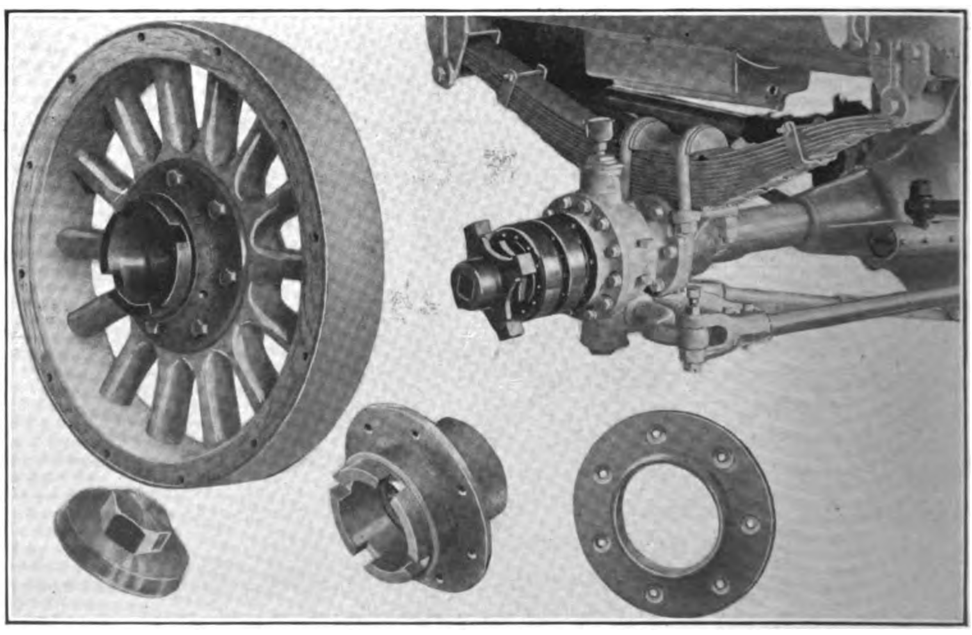
Double Differential Lock.

With this lock the trucks may be driven by either the front or rear wheels as exigencies may require. That is, for temporary use the front or the rear axle may be used, but in the vent of damage or accident the lock lever (there are levers at the front and rear ends of the gearset case) nearest the axle that is used for power is set. If the front or rear driving shaft only is to be used for any period the shaft not in use can be disengaged, and the truck can be driven by two wheels, either front or rear, until restoration can be made.

The rear axle is a full floating construction, the wheels revolving on bearings mounted on the ends of the axle housing, and there is the customary form of differential gearset and the floating shafts, the wheels being driven by clutch plates that mesh with jaws cut in the end of the wheel hub. This axle is trussed to insure strength.

Full Floating Front Axle.

The front axle is a heavy steel housing, enclosing the shafts and the differential gearset, but the shell consists of four sections, the left half (as seen from



Front Axle with the Bearings and Shaft and a Wheel and a Hub, Flange and Cap—This Illustrates the Strength of the Construction.

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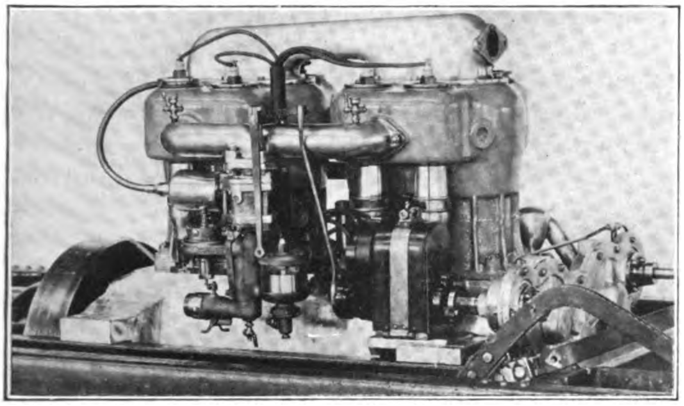
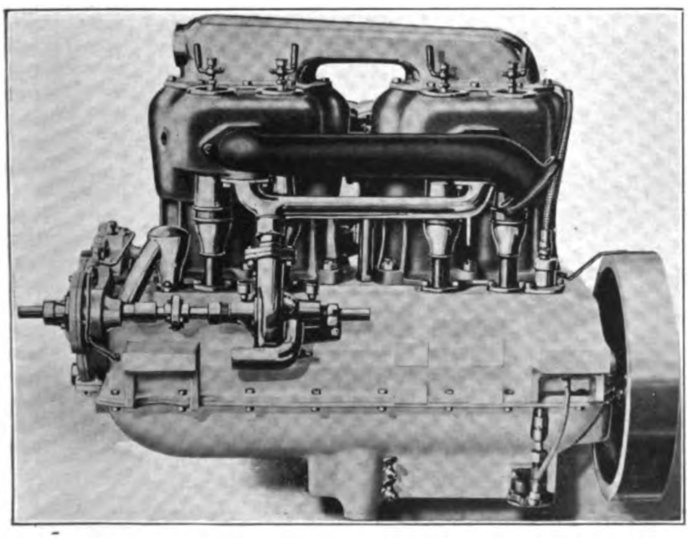


The Intake Side of the Specially Constructed Wisconsin Engine with Which These Trucks Are Equipped.

the driver's seat) of the main or central section being the longer. To the outer ends are bolted the hollow balls of the ball and socket joints. These balls have sleeves that extend into the ends of the main housing. Forged with the balls, at the top and bottom, are lugs that are formed into heavy pivots on which the sockets (which carry the sleeves or outer ends of the axle) are swung. These pivots are fitted with steel bushings.

The sockets are formed in two sections that encircle the balls and these have smaller vertical sockets, into which the pivots are fitted. On the tops and at the bottoms of the pivots are hardened steel buttons that are adjustable by plugs and nuts. On top of the adjusting nuts are grease cups that lubricate the buttons, and the lubricant is carried through ducts in the adjusting nuts, buttons and pivots to the inner sides of the balls, and to the universal joints within the balls. The load is not carried on the balls, but on the pivots and the wheels and the sockets swing on the pivots. The sockets that enclose the balls are in two sections and are bolted on to what are known as skeins, these skeins being steel drop forgings that are carefully proportioned. There is a very large wearing surface for the sockets and wear is compensated by the renewal of the bushings of the pivots when this is necessary. The skeins retain or carry the sleeves



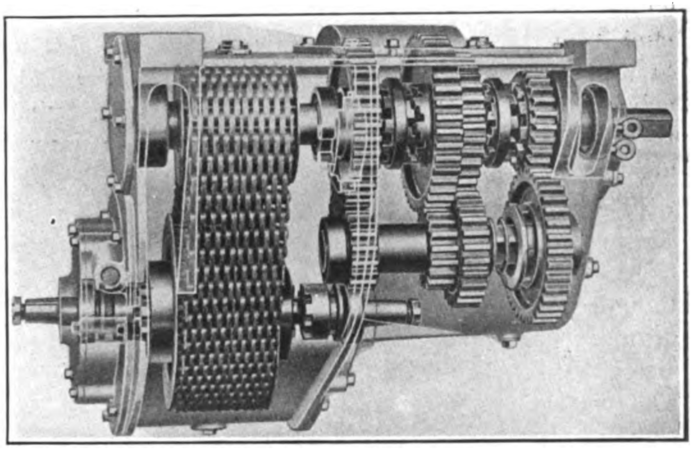
Exhaust Side of the Wisconsin Engine, Which Is Built with a Special Type of Water Outlet Manifold.

that extend from the sockets on which the wheels revolve on bearings. The bearings are maintained in their relation by lock nuts and washers, and by these nuts and washers adjustment of the bearings may be made. The wheel bearings, lock washers, skeins, spiders or wheel clutches and the hub caps are the same as are ordinarily found in the construction of a full floating axle of a rear wheel driven machine.

Two Universal Joints in Shafts.

The driving shafts are fitted with universal joints that centre directly below and above the pivots of the ball and socket joints, so that no matter what the angle of the turn may be the driving power is always fully applied and there is no side pressure on the shafts. The claim is made that the construction of the axle makes for greater strength than is possible to obtain the conventional I beam with yoke and pivot, because of the large area of the ball and socket joints and the pivots, while the joints may be adjusted by the plugs and lock nuts, so that there will always be perfect relation and no lost motion.

The frames are chrome nickel steel channel sec-



The Main Transmission Gearset and the Sub-Transmission Gearset, the Latter Being Driven by a Silent Chain from the Shaft Extension.

tions pressed to form, that are heat treated to insure extreme strength. The frames are built on straight lines. The sub-frames, that carry the power plant, clutches, transmission gearsets and sub-transmissions, are constructed with deep, heavily webbed side, end and cross members, the side members paralleling the main frame side members. The frames are cut and drilled by jigs and all parts are interchangeable. They are hot riveted with vanadium steel rivets. The side members of the frame are not cut, save for the rivets of the spring hangers.

The Frame Suspension.

The frames are mounted on semi-elliptic springs forward and platforms of three semi-elliptic springs at the rear. The forward ends of all the springs are pivoted, those of the forward set to the horns of the chassis frame and those of the rear set to hangers, and the rear ends of the rear springs are shackled. The driving thrust of both axles is through the forward ends of the springs, this being a practise very generally followed in Europe, and which has been approved

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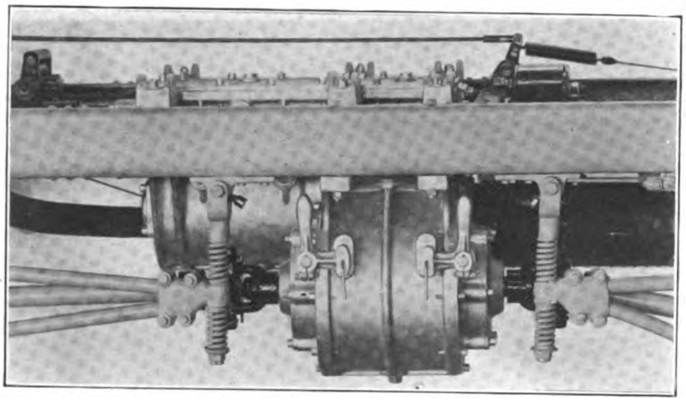


The Gearset and Sub-Transmission Case, Installed in the Chassis, and the Skeleton Type Torque Rods Suspended on Springs.

by a considerable number of American truck builders. This is known as the Hotchkiss drive. All the driving and braking stresses are taken by the springs, and there is a resiliency in them that is not found with other forms of frame suspension that adequately protects the mechanism of the machines from these and the strains of road shocks. The relations of the front and rear axles with the sub-transmission gearset are maintained by torque rods of skeleton type that extend from the front and rear axles at the left side to vertical pins pivoted on the chassis frame, the ends being supported at the pins by helical springs that cushion them against any upward or downward movement.

The wheels are mounted on the outboard ends of the rear axles and on the sleeves at the ends of the front axles. These wheels are interchangeable, although the rear set is fitted with pressed steel brake drums. The wheels are usually shod with the same size tires, so that these are interchangeable as well. The wheels are very strongly constructed and designed to have extreme rigidity.

At this point a word of the bearings and shafts of the trucks is desirable. All the shafts are made of special steel, carefully forged and machined and heat treated. All the gears are made of special metal, having wide faces to insure long endurance. Annular ball bearings are fitted in all the transmission gearsets and sub-transmission gearsets, but all the differential gearsets are mounted on roller bearings. The wheels of the 1½-ton truck are carried on Timken roller bearings, and the wheels of the three-ton truck may be fitted with any standard type roller or annular ball bearing, these types being interchangeable in the bearing seats. The five-ton trucks chassis have tapered roller bearings in the wheels, the differential and the transmission gearsets.

The trucks are driven from the right sides and by Ross irreversible steering gears. The cross type is used for the two smaller trucks and the fore and aft type for the five-ton machines. The linkage is very heavy and means are provided for compensating for wear.

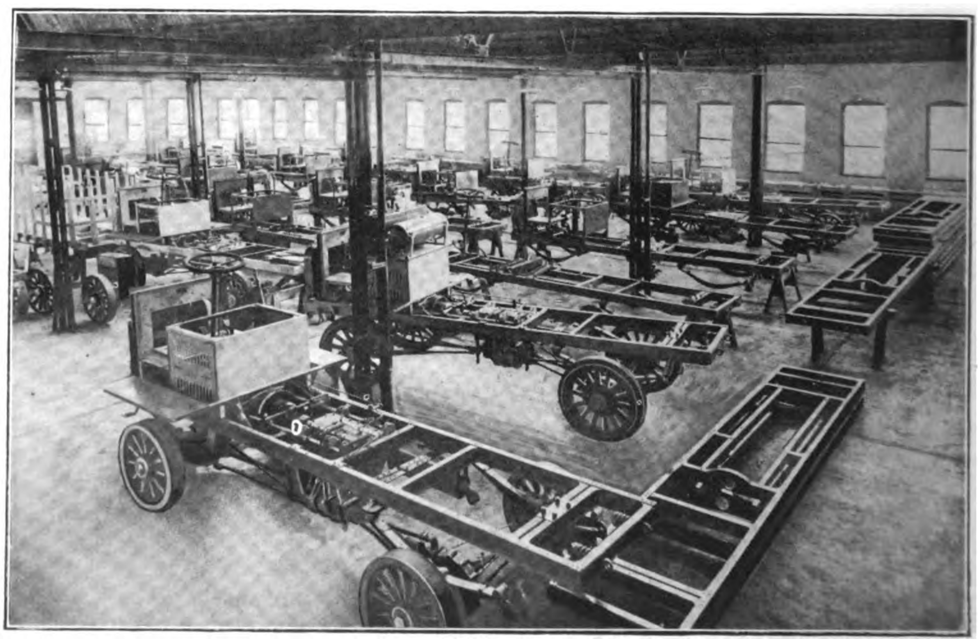
The Control Elements.

The control of the trucks is by the usual foot pedals for the clutch and the service brake. The service brake is a steel drum mounted on an extension of the main driving shaft at the rear end of the transmission gearset case, which is clamped by a contracting band lined with anti-friction material. The gears are shifted by a hand lever and the emergency brake is operated by a hand lever, both at the right side of the driver. The fuel supply and the ignition spark are controlled by hand levers on quadrants on the steering wheel. The emergency brake is an external contracting type operating on drums on the rear wheels. All the brakes are large in area and are designed to be extremely efficient.

The 1½-ton truck has wheelbase of 124 inches, tread of 56 inches, chassis length of 200 inches, and loading space 136 inches length. The three-ton truck has the same wheelbase, tread, chassis length and loading space. The five-ton truck has wheelbase of 148 inches, 72 inches tread, chassis length of 260 inches and loading space of 162 inches. The 1½-ton truck has tires 36 by four inches, the three-ton truck has tires 36 by six inches, and the five-ton truck 38 by five-inch dual tires. The chassis are governed to maximum speeds of 16, 14 and 8-10 miles an hour respectively in order of size.

The Gearset Reduction Ratios.

The gear reductions in the transmission gearsets are: 1½-ton truck, 1:9.75, 1:19 and 1:39 for high, intermediate and low, and 1:40 in reverse: three-ton



A Section of the Assembling Floor of the Plant of the Four Wheel Drive Auto Company at Clintonville, Wis.

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truck, 1:9, 1:17 and 1:35, and 1:36 in the same order, while the five-ton trucks has ratios of 1:12, 1:22.5 and 1:46 forward, and 1:55 in reverse. The chassis price of the 1½-ton truck, which includes oil, dash and tail lamps, jack, horn and kit of tools, is $3600; the price for the three-ton chassis is $4000, which includes tool box, oil cans, horn, hub cap, motor and magneto wrenches, oil, dash and tail lamps. The chassis price for the five-ton truck is $4800, and the equipment consists of oil, dash and tail lamps, two tool boxes, full set of tools, oil cans, horn and hub cap, motor and magneto wrenches.

The four wheel traction obtainable with these machines is claimed by the maker to be especially economical of tires and fuel and lubricant. Tire figures are somewhat dependent upon the make used. The difference in cost of tires, single and dual for the two-wheel driven machine, and the single bands for the four wheel driven truck, will range from 20 to 25 per cent. less for the latter equipment for the 1½ and three-ton trucks, and the mileage cost is in like ratio if the tires endure the same length of time.

Large Claims for Tire Economy.

But claim is made that the tires of the four-wheel driven trucks will endure much longer periods, or rather mileage, than is specified in the tire guarantees. For instance, they have service life ranging from 33 to 120 per cent. more than the mileages guaranteed for the equipment for two-wheel driven machines, the economy being both in investment price and in reduced mileage cost, the aggregate saving being very large when compared with the average period allowed for truck life—five years—and from 10,000 to 15,000 miles a year. Considering the endurance of Four Wheel Drive trucks in excess of the general allowance for two-wheeled machines, this is another very material economy.

The direct saving in cost of fuel and lubricant because of the better utilization of power and greater mileage or more work performed is a factor of decided importance, and through the equalization of the freight carried and the application of the power to all four wheels the cost of repair and restoration is very low—so small, in fact, that the manufacturer maintains that the expense for mechanical work and parts renewed will vary from 15 to 25 per cent. of what would be required for the upkeep of two-wheel driven vehicles.

MARKET BUYS WHITE TRUCKS.

The Westlake market of Seattle, Wash., a very large provision concern, has decided to standardize its delivery with trucks and is abandoning horses. It has bought two White ¾-ton trucks and one White 1½-ton truck. There are many White machines in Seattle, where the hills are steep, and their work on these grades has been very satisfactory. With these trucks the roller tray system of loading is being used to good advantage. It saves about 40 minutes of loading time on each trip.

F. W. D. ENLARGES ITS PLANT.

Rapid increase in business has forced the Four Wheel Drive Auto Company of Clintonville, Wis., to enlarge its plant and add to its equipment. A new stock room, 46 by 120 feet, is being built, and a number of new heavy duty turret lathes, milling machines, boring bars and drill presses are being installed. There will be a new machine section in the building 54 by 120 feet, and a new heat treating and tempering room, 20 by 40 feet. This will be equipped with large furnaces and electric pyrometers.

The company has just completed a big building entirely separate from the rest of the plant, which will be used for the storage of oils, greases and paints. It is entirely fireproof.

There is a big exhibit of the Four Wheel Drive Auto Company at the Panama-Pacific exposition which is attracting much attention. F. H. Burdette, one of the company's travelling representatives, has charge of this exhibition.

CHASE DIRECTORS ELECTED.

The Chase Motor Truck Company, Syracuse, N. Y., which recently announced that its business during the past year had increased 218 per cent. exclusively on domestic business, has chosen the following directors to serve for the ensuing year: A. M. Chase, president and general manager of the company; Col. A. C. Chase of Syracuse; L. O. Bucklin, president Little Falls National Bank, Little Falls, N. Y.; E. C. Witherby, general manager Semet-Solvay Company, Syracuse, N. Y., and H. P. Bellinger, general manager of the caustic department of the Solvay Process Company, Solvay, N. Y. At a meeting to be held shortly after the first of December the officers of the company will be named.

CAN'T START TRUCKS ON FERRIES.

The United States government is fining ferry companies about New York City $500 for every time drivers of trucks or cars start their engines before the boats are fast to the docks. The ferry companies under the law can require that all gasoline be taken out of the tanks before the cars or trucks are taken aboard and they threaten to enforce this provision if drivers persist in running their engines on the boats.

WRIGHT IS FEDERAL CHIEF ENGINEER.

B. F. Wright, chief engineer of the Federal Motor Truck Company, is in charge of the research and engineering work of the company. The statement that Mr. Mead, who recently left the Packard company to join the Federal company, was to direct that part of the work was erroneous. He will confine his activities to production work.

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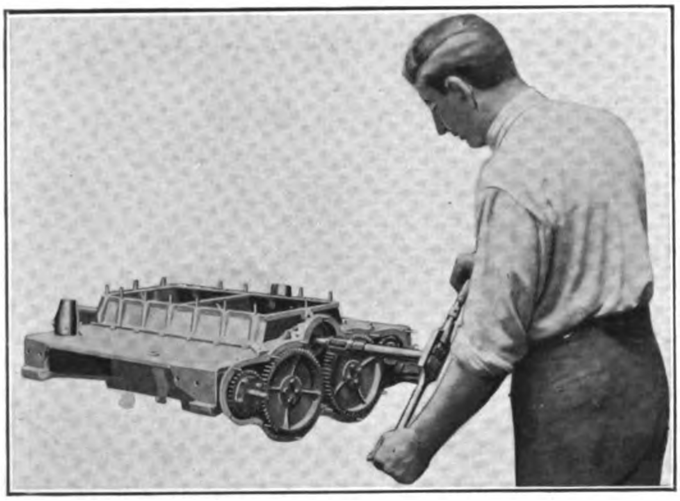
ALIGNING AND FITTING ENGINE MAIN BEARINGS.

By A. A. MARTELL (Harding Manufacturing Company).

ENGINE efficiency depends primarily upon the alignment of the main or crankshaft, which is governed by the bearings upon which it is mounted. The shaft must have perfect or true relation with the connecting rods and the pistons. When the engine is built, the main shaft is mounted with extreme care, and while there is expectation that the bearings will wear considerably, and the shaft itself slightly, means are provided for compensating normal wearing by adjustment with shims. These shims are thin strips of metal placed between the edges of the bearings so that, as the wear becomes evident, the removal of one or more shims at either side will bring the surfaces of the bearings for their full length in more intimate contact with the surfaces of the shaft.



Martell Aligning Reamer "Set Up" in the Crank Case and Adjusted for Reaming the First Main Bearing.

If the bearings are worn, which may result from numerous causes, the only restoration possible is to make the surfaces perfectly even, so that they will again contact uniformly with the shaft. This is usually done by what is known as "scraping," the process being to determine the high and low portions and removing the higher points. Bearings may be either bronze, or an anti-friction metal, but the latter is generally chosen because it will strongly resist wear when properly lubricated and it can be readily replaced when necessary.

When the bearings wear, there is play and side pressure on them, and the shaft, and then the shaft will not turn true. This causes noise and loss of power, and the other bearings are worn in like proportion. Fitting bearings, or "scraping" as the work is termed, is necessarily a work of extreme accuracy, but perfect fitting is practically impossible to obtain by hand methods. The bearing metal is very soft. By coating the bearing with a pigment known as Prussian blue, or any similar substance, clamping the shaft in it and turning the shaft, the pigment will be worn from the high parts, or the "spots," that contact with the shaft.

Difficulties of Fine Scraping.

With scrapers these "spots" are cut away, the chips being extremely thin, and this process is repeated until the bearing will show "bright" practically over all its surface. Scraping is delicate work, for the slightest cut below the line of contact will necessitate repetition of fitting. Men who are engaged in this constantly become highly proficient and can fit bearings very accurately, but such mechanics are not frequently met with outside factories and large service stations. Obviously the average mechanic does have such work so often that he can become expert in it, and the time required for an average restoration necessarily means a considerable addition to the cost for labor.

Then there are two factors to be considered in bearing fitting—the quality of the work and the expense. To obtain accuracy, time, patience and care are essentials, for unless the bearings fit, engine efficiency is sacrificed and power is lost, to say nothing of the quick deterioration of the bearings of the entire assembly.

Need of Accurate Gear Meshing.

But there is another factor that is not generally regarded, and that is the necessity of having the gears of the timing gear set—those that drive the camshaft and the magneto and pump shafts—in correct mesh. The bearings may be well fitted so far as the crankshaft is concerned, but alignment so that the gears are accurately meshed is absolutely necessary to obtain a perfect functioning engine. One may say that all other work can be well done by the expert mechanic, but the accuracy of the bearings—and there may be two, three, four or five or more for an engine—cannot be checked when hand scraping is the only means for restoration.

Efforts have been made to utilize broaching machines for bearing fitting in some of the large factories, which would insure perfect accuracy, so far as the bearings themselves are concerned, but no matter how carefully a crankshaft has been ground it will vary sufficiently so that some hand fitting is necessary for each bearing.

Martell Aligning Reamer.

Within the past two years the Martell Aligning Reamer has been used for reaming and it has afforded a character of work that is superior in every way to hand work, and in addition to this, each bearing can be fitted to its particular crankpin, so that when the work is completed the gears are accurately meshed, the shaft is positively in line, and the bearings are finished as smoothly as though they had been "worn in"

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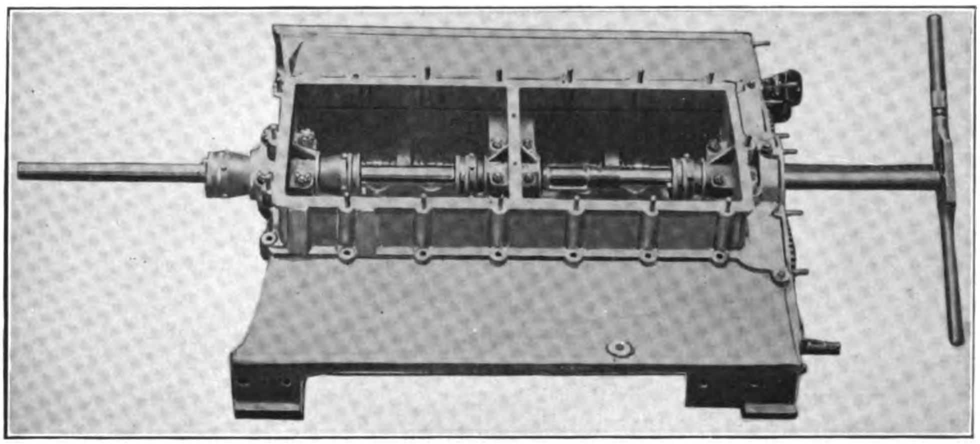
by a period of service corresponding to several hundred miles driving.

Statement may be made that the engineers who conceived and perfected this tool were familiar by actual first-hand experience with the fitting and aligning of engine bearings. They sought to obviate all the inaccuracies of hand work as well as minimize the cost of labor, and broadly speaking, the tool was intended to be as nearly universal in its uses as was possible—that is, it could be used on engines of all sizes, designs, constructions and number of bearings, and operated by men of average mechanical skill and practically perfect results obtained.

To obtain this quality of work a basic point or points were of necessity selected for supporting the reamer shaft, and these were naturally the seats for the main bearings, which are identical in principle with all engines. While these seats and the bearings they contain may vary in diameter and distance apart, they were regarded as being the only satisfactory means for carrying the reamer shaft in a positive position.

The reamer shaft is a substantial steel bar that is turned with a handle that resembles a die stock, which is locked on the end of the shaft when it is used. With this, the reaming is done by reamer heads that carry the reamer blades, and adjustable supporting bushings that are fitted in the bearings and on which the shaft is carried. The reamers are made in two sizes, No. 1 for work on bearings for shafts from 1⅝ to 2¼ inches diameter inclusive, No. 2 for shafts from 1¼ to 1⅝ inches diameter inclusive.



Reamer in Readiness for Reaming the Centre Main Bearing, Showing the Adjustable Bushings by Which the Shaft Is Aligned and Correct Meshing of Gears Obtained.

No. 1 includes a long aligning reamer shaft, two reamer heads (one large and one small), six adjustable supporting bushings, six sets of six blades each, one short aligning shaft for reaming connecting rods, spanner wrenches, crankshaft gear bushings, etc. No. 2 includes a long aligning reamer shaft, one reamer head, five adjustable supporting bushings, three sets of six blades each, one short shaft and the wrenches and bushings.

To use this equipment the engine may be mounted on horses, although with some engines, reaming can be done without removing them from the chassis. The sizes of the engine shaft crankpins are obtained by calipers and the reamer head is set by micrometer adjustment, allowance being made for the clearance necessary for the distribution of oil.

How Adjustment Is Obtained.

The reamer shaft is supported by conical bushings having fine threads on the conical surfaces, with lock screws to secure the inner bushings. These conical bushings are bored to receive two other bushings, both of which are slightly eccentric. These eccentric bushings have flanges on the edges of which are graduations reading in thousandths of an inch and indicating the degree and the direction of the movement of the reamer shaft, which is supported directly by the inner bushings. Three or more of these bushings are used in setting the reamer shaft, and by the very delicate and accurate adjustments, easily and positively obtained, the mechanic can be absolutely sure just what the alignment will be before cutting is begun.

The bushings are screwed into the ends of the bearings, or the holes to be reamed or bored. The crankshaft timing gear is mounted on the reamer shaft on a special bushing. The adjustable bushings are then turned to points where the timing gears mesh perfectly, the basic point being the timing gear, from which the bushings are set and secured when accurate alignment has been obtained.

The first bearing is then reamed by turning the reamer shaft by the handle or cross lever, and each bearing is reamed in turn, the bushings being removed as the bearings are reached. Obviously each bearing is cut true, in absolute alignment and to the predetermined size, the surfaces being polished and consolidated by the cutting as though by wear. With the two sets of tools all bearings from 1¼ to 2¼ inches may be reamed, and with the short shafts connecting rod bearings can be finished equally as well.

The reamer can be utilized in all repair shops, garages and service stations, in the shops of concerns operating fleets of trucks, or in factories where the number of engines produced is not sufficiently large to justify a mechanical method of fitting the bearings.

STEEL HORSE TRACTOR COMING.

The Steel Horse Company of Milwaukee, Wis., plans to manufacture a general utility tractor. The company is capitalized at $25,000 and is backed by William B. Reith, Walter D. Mann and Adolph C. Graf. The tractor is designed especially for farm uses and will haul a plow, cultivator, seeder, harrow or other light farming implements and can be used for light haulage of other kinds.

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INTERNATIONAL PRICES CUT.

New Market Values Established and Plans Made for Large Production.

Sweeping reductions in the prices of the trucks built by the International Harvester Company of America are announced, which set new low levels for vehicles of standard design and construction made by a well known company.

There are now four types of trucks in the line, for loads of 1000, 1500 and 2000 pounds, ranging in price from $600 to $1500. Two new models have been added this year, the 1500-pound truck, which sells for $950, and a ton truck chassis, which sells for $1500.

Two large six-story additions to the factory at Akron, O., are under construction and these will provide space by which it will be possible to double the capacity of the plant. This will make it one of the largest, if not the largest, exclusive motor truck factory in the world.

The truck business of the Harvester company was recognized at the Panama-Pacific Exposition by a medal of honor granted by the International Jury of Awards.

The line is now complete, deep cuts in prices have been made, manufacturing facilities have been greatly extended, the selling and service organization is larger than those of any other truck producer, so that everything is ready for an exceptionally large business during 1916.

International trucks have been produced for eight years and there are said to be more Internationals in use than any other truck made. The volume of sales during the first half of 1915 was greater than the entire sales for the year of 1914. Big truck using centres like Chicago and St. Louis have more International trucks than those of any other make. The branch selling and service organization is the most complete in the United States. The Harvester company's truck works is the largest purchaser of solid rubber tires in the world.

It is the immense production, shown by facts and figures like these, that has made the reductions in price possible, although the quality of the trucks is similar to that of former years.

For the next year any of the four models may be equipped with either solid or pneumatic tires. The two half-ton capacity models may be built either with 36 or 42-inch wheels to best fit the trucks for use in the conditions in which they will be worked.

The Motor Engineering Company of Cleveland, O., has been organized by C. S. Goby, formerly chief engineer of the Goby Engine Company. It will manufacture motors and automobile parts and conduct experimental work, such as designing and general engineering. A new factory now building in West Third street will be occupied about Jan. 1.

HAVE SOLD 8000 PACKARD TRUCKS.

In 10 years Packard motor trucks to the number of 8000, valued at about $20,000,000, have been sold, according to C. R. Norton, truck sales manager of the Packard Motor Car Company. These figures do not include trucks sold for export. The money invested in Packard trucks is cited as proof of the great value to modern business of power vehicles. That the service of trucks has been very satisfactory and economical is shown by the fact that a greater part of the machines sold have been repeat orders.

NATIONAL EMPLOYERS' ASSOCIATION.

At the 19th annual convention of the National Founders' Association held recently in New York City, a proposal to form all manufacturers and industrial employers into a single great organization to fight the legislative and labor battles of the future was discussed. The federation proposes the appointment of committees from all organizations of employers now existing to take up in a central body such matters as foreign trade, tariff, business legislation and wages.

INCREASES OF CAPITAL.

The Columbia Castings Company has increased its capital from $30,000 to $100,000; the capital of the Christie Kline Forge Company has been increased from $3000 to $10,000, and the capital stock of the O. K. Motor Truck Company increased from $10,000 to $25,000. The latter has changed its name to the Lincoln Motor Truck Company. These concerns are located at Detroit, Mich.

JOIN FOUR WHEEL DRIVE COMPANY.

Mr. J. S. Hurd of Philadelphia, formerly associated with the Gramm-Bernstein Company of Lima, O., is now travelling representative of the Four Wheel Drive Auto Company of Clintonville, Wis. F. A. Cole of New York City, who was connected with the Four Wheel Drive Company of Clintonville, has again joined that company as a travelling representative.

The Battle Creek Motor Truck Company, Battle Creek, Mich., is planning a new plant to manufacture a new four wheel drive truck of ¾-ton capacity. The men chiefly active in the company are Maurice Bollstrom, designer of the truck; F. E. S. Tucker, an advertising agent, and J. E. Fellows.

The new highway code for Ohio, promulgated by the highway commissioner, makes illegal riding on any vehicle without the consent of the driver, allowing domestic animals the freedom of roads and permitting unnecessary emission of dense smoke from motors. It is also suggested that all vehicles carry lights.

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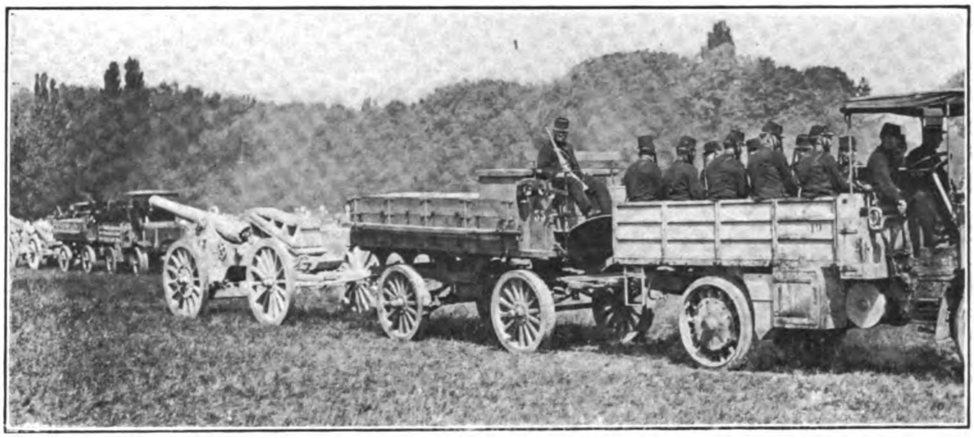
INTERNAL GEAR DRIVE OPERATING ECONOMY.

By GEORGE B. RUSSEL, the Russel Motor Axle Company.

IN VIEW of the steady growth of the use of internal gear drive axles for motor trucks by American manufacturers, it is interesting to look into the causes that have been responsible for its increasing popularity.

Internal gear drive axles have been built in the United States for several years—ever since motor truck makers have realized generally the thorough efficiency and reliability of this type. This recognition has come primarily by reason of three causes: First, the increased skill of engineers superintending motor truck design. Second, a better understanding of the needs of the truck user; and third, the commanding necessity for reducing operating costs to their real minimum.

It is recognized by motor truck designers throughout the world that the hardest test to which a truck may be subjected is that of prolonged army service. The military truck cannot always be taken over the best roads. It must cover the shortest, safest route to the front. Sometimes this means pulling through ditches, over soft fields, in woods and up and down steep, rough grades.



Internal Gear Driven Trucks Used by the French Army for Transporting Troops and Hauling the Heavier Pieces of Artillery.

Its proper and consistent lubrication is a matter of opportunity. It is sometimes handled by inexperienced men and often goes without needed repairs for long intervals. When it does go to the repair shop its value depends largely on its design, in that repairs must often be made with crude tools utterly inadequate as compared to a factory repair shop.

Limited Field Repairing Facilities.

It is absurd to suppose that an army field repair shop can carry at all times the complicated jigs and other accessories for making accurate and minute adjustments that are required under some conditions of design to assure even average every day service under ideal traffic conditions. It is, therefore, a prime necessity for army officials to insist not only on extreme simplicity in the design of motor trucks, but upon such design that will permit repairs and replacements to be made in the quickest and easiest way possible.

Although the connection between European army conditions and problems that have confronted American truck engineers may not seem a close one at first glance, there is a direct and strong relationship that has had a great deal to do with the trend toward the internal gear drive principle in this country.

Supplies of Repair Parts.

A condition that confronted the American truck manufacturer, once he began to obtain country-wide distribution for his products, was the maintenance of a supply of parts that would be available quickly for all users of his machines. Manifestly it was impossible in a country with an area of more than 3,600,000 square miles to expect every motor truck owner to rely for his repairs and replacements on a single factory repair depot, no matter how centrally located it might be. And if his design were too complicated, or if it were of a character to demand the installation in every dealer's territory of not only a costly lot of parts, but expert assemblers and expensive machinery for securing absolute accuracy, his efforts were doomed beforehand to failure.

Obviously, in order to secure facilities for quick repairs throughout the country the manufacturer must have a chassis wherein simplicity and ease of adjustment are the dominant features, so that repairs may be made by any competent repairman with his ordinary equipment. Motors were nearly standard a few years ago and so were transmissions. But rear axles for motor trucks were not standardized and so the real problem has centred about this unit.

European Army Approved Design.

France, Germany and Austria had solved the question of the best design for a motor truck. The four-cylinder motor, the three and four-speed transmission and the internal gear drive rear axle were their answer to the army's necessity, which in European countries has always been an important factor in engineering matters.

But in this instance America did not need to follow Europe in design. Engineers and axle manufacturers in this country had been experimenting too, and al-

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Convoy of Paris Motor 'Buses Loaded with Fresh Meat for the Army in the Trenches Awaiting Moving Orders—These Machines Are Internal Gear Driven.

though they did not have exhaustive military trials to help them perfect their designs, they arrived at results just as truly as did the European engineers.

The American engineer had, if anything, brought this type of axle to an even higher state of development than had been reached on the other side of the Atlantic. He had found by theory and proved by practise that cut gears were more adaptable to American needs than the cast gears that were used on some of the European axles. He had succeeded in reducing the weight while increasing the strength, and had increased the efficiency by the proper application of anti-friction bearings. Not only had these things been accomplished, but the design had been simplified to an extent that enabled every dealer in any given make of motor truck using this type of axle to lay in an adequate supply of parts to give instant service without tying up a large amount of money.

America Solved Problem Differently.

This was due to the fact that interchangeability ruled throughout, no increase was needed in his shop equipment and, above all, ordinary repairmen could not only assemble a new axle, but could fit new parts in old ones with only the experience that would enable them to make the customary touring car repairs on any standardized part.

This phase of the matter has appealed strongly to the owner, too, in that if axle repairs should become necessary they can be made in his home town or, in fact, in his own garage by his own driver, in a short time without recourse to the truck or the axle manufacturer. Those are, in brief, factors that have appealed strongly to user, dealer and manufacturer. To the engineer the internal gear drive axle realizes ideals of design, assembly and service heretofore unattainable.

Load Carried on Solid Axle.

In the first place he has a solid load carrying member. This gives him at once the greatest point in the favor of the chain drive without any of the accompanying difficulties that arise from the chains themselves. The wear on the gears and pinions is not appreciable and entails no loss in efficiency. The absence of absolutely perfect adjustment does not harm the gears nor does it result in more than a purely theoretical loss of power. Moreover, extreme misadjustment gives instant notice of itself, in that respect differing from certain forms of final drive in which the only warning comes after the damage has been done and a gear destroyed.

In the internal gear drive axle the load is carried on the solid member, while the power is conveyed to the rear wheels through a bevel gearset and jackshafts held in a fixed relation to the solid axle. None of the weight of either truck or load comes on it. All stresses that are laid on this member of the axle unit are those of power, and as the jackshafts are high speed members they may be light in construction. Taken altogether the axle unit weighs much less than is possible in any form of live axle construction where the housing and load carrying members are one and where, consequently, great weight is necessary in order to give sufficient strength for motor truck work.

Reduction of Unsprung Weight.

The matter of heavy axle construction leads directly to another point in the principle of the internal gear drive axle that makes a strong appeal to engineer, manufacturer and user alike. Tire experts have frequently given their authority to the statement that unsprung weight—that is, weight that is not supported on springs, is from eight to 10 times harder on tires than sprung weight, or that part of the weight of chassis, body and load that is supported on the springs. This means that if the entire truck and load were to be unsprung the life of the tires would be only between 1/10 and 1/12 of that under normal or sprung conditions.

Consequently any increase of unsprung weight in any one type of unit in one make of truck over another type of unit in another make gives the truck with the lighter form of construction a marked advantage, other considerations being equal. For that reason the engineer who has incorporated an internal gear drive axle in his truck design has a very perceptible advantage over his brother who is forced to adopt a heavier type with a cast and built up form of load bearing housing.

By using a smaller size tire he can obtain the same mileage as the other man and by using the same size

Paris Internal Gear Driven 'Bus Transformed for Carrying Troops—This Is a De Dion-Bouton Chassis.

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De Dion-Bouton Special Internal Gear Driven Chassis Equipped with a 75mm. Gun for Attacking Aircraft in French Army Service.

tires he has assured greater mileage for the truck he designs. The saving in weight will be appreciated when it is understood that the excess weight in the built up form of axle housing causes a variance of as high as 25 per cent. in total weight. This point makes a direct, certain appeal to the owner who, in order to get his proper profit from motor truck operation, must keep his costs down to an irreducable minimum.

Efficiency of Power Transmission.

All of these questions, however, have little to do with the transmission of power to the rear wheels, and it is through its advantages in this respect that the internal gear drive axle has won some of its stanchest advocates in engineering circles. The application of power transmitted from the motor is, like the chain drive, near the rim of the wheel. The leverage is much greater than in any type of axle in which the power is applied at the hub.

Parts may be made lighter, inertia overcome with less power applied and there is a great lessening of strain throughout the train of driving members. The chain drive has always been regarded as good in this regard, the disadvantages being that sprockets would wear, chains stretch and lubrication be made difficult. None of these disadvantages pertain to the internal gear drive type of axle, as the gears have been shown to be little subject to wear, they are enclosed and there are no difficulties of lubrication. These, with the solid load bearing member, are factors that have led internal gear drive advocates to insist that this axle has all of the advantages of the chain drive, with none of its mechanical disadvantages.

Trucks Proved Their Own Economy.

An interesting side light on the high efficiency of the internal gear drive axle has just been observed in the fact that several factories manufacturing trucks with this axle have had recently more applications for Pacific Coast agencies than they could care for. An investigation by factory representatives brought out the reason for this sudden access of interest. It seems that in the cities in question traffic conditions are especially severe. Steep grades are complicated by rough and in some places soft pavements. With these conditions some trucks equipped with other types of axles have found it impossible to cope.

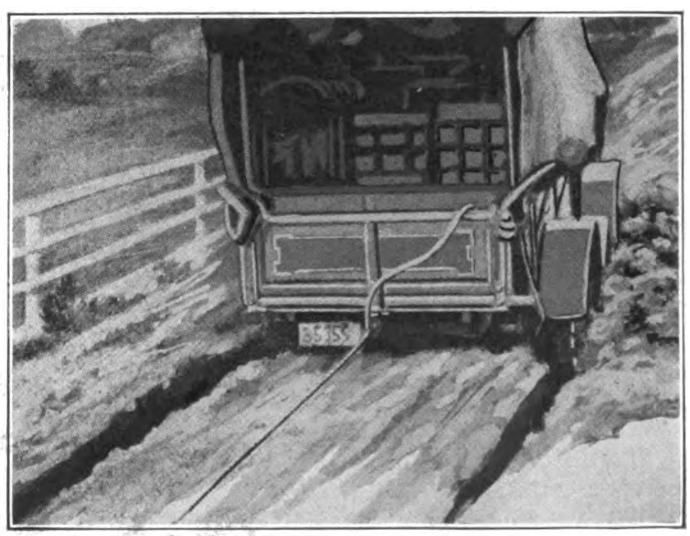
Recently several installations of internal gear drive axle trucks were made by prominent companies and the success of these fleets under the bad conditions of going was so apparent that dealers at once ascribed the success to the axle equipment and were quick to try to establish agency relations. This Pacific Coast condition is illustrative of the efficiency of the internal gear drive axle under the most adverse conditions.

Here it was necessary to do a great deal of hauling over grades and under conditions where slow speed and low gear work were the rule. It demonstrated positively under actual service circumstances that low speeds did not cut down the axle efficiency which has been a great drawback to the successful operation of certain other types. The efficiency of the internal gear type does not vary with a change in speed. There is a negligible loss through friction in the meshing action of gears and the driver may be certain at all times and under all conditions that the power generated by his motor is going practically undiminished, direct to the back wheels.

Possibilities with Trailers.

Any description of the qualities of the internal gear drive axle would be incomplete without an explanation of its adaptability in the use of trailers. Makers of motor trucks have on several occasions recently proposed taking action to stand against the use of trailers by owners. No plan of action has been agreed upon and it is doubtful if the makers of internal gear drive trucks would join in any such movement.

The whole question has hinged on the damage that might be done to rear axles in which friction plays a large part in the power transmitting mechanism. In worm gear drives not only the efficiency, but the life of the axle itself depends absolutely on the presence of a thin film of oil, which is very apt to be squeezed out by the sudden application of greatly added pressure such as might come from the pull of a trailer. No



Denby Truck with Load of 2100 Pounds, Towing a Six-Cylinder Touring Car Through a Road Nearly Axle Deep with Mud.

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A Section of the Assembling Department of the Russel Motor Axle Company's Factory, Where the Workmen Are Fitting the Jackshafts Together.

constantly attacked with the object of continuous development.

Two of the accompanying illustrations are of the factory of the Russel Motor Axle Company, North Detroit, Mich., builder of the Russel internal gear drive axle, a type that is very widely known. This is used in the construction of a number of trucks, among which are those built by the Denby Motor Truck Company. Another illustration is that of the rear end of a Denby truck carrying a load of 2100 pounds and towing a six-cylinder touring car through a road that was cut nearly axle deep with ruts. This machine was, at the time the picture was made, the first vehicle of any kind that had been driven through the road for 10 days, and one day this truck was driven but 27 miles, so difficult was progress, and that was in the low gear ratio.

Incidentally this truck was tested in experimental development of the vehicle by a drive across the continent, and after being driven for 3000 miles examination of the internal gears, which are made of specially hardened alloy steel, showed no appreciable wear.

The other illustrations in this article are from pictures made abroad, chiefly in France, where thousands of internal gear driven machines are in the service of the French army. These are in most part trucks that have been built under the French subvention system or have been commandeered because of the exigencies of the service. Only the former class of vehicle can be regarded as being adapted for army service, but the machines appear to have adequate power and endure surprisingly.

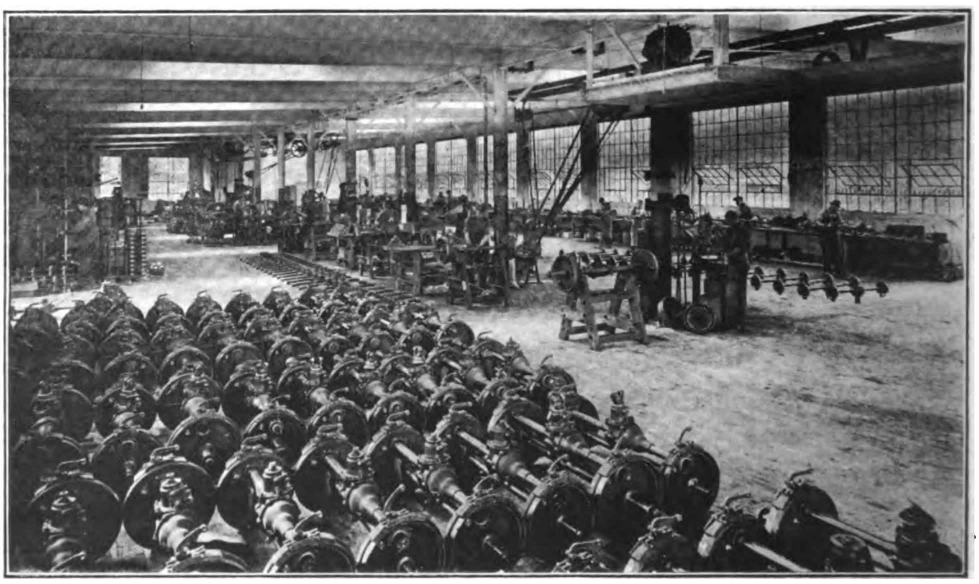
such danger exists in internal gear drive axles, however, and makers of trucks of this type have, without exception, refused to take a stand against trailers.

Specialized Building of Axles.

While a considerable number of internal gear driven truck builders produce their own axles, a majority of the manufacturers obtain them from concerns that specialize them, in this respect following the recognized policies of a very large part of the motor vehicle industry, which is to utilize design and construction that has been developed by service and experience and perfected by scientific methods.

That is to say, that an axle manufacturer devotes his entire energies and resources to the development and perfection of what may be regarded as standardized products, having engineering specialists to study and improve the mechanism from the viewpoints of service, of material, of manufacturing methods, of efficiency, of production economy and such other aspects as are impelled by differing competitions. Such products must have quality and merit to be accepted by engineers who understand that economy and endurance are vitally essential in the machines they build.

In the works of such specialists are the finest machine tools and fixtures for accurate and economical production, and the methods for heat treating, testing and inspecting the vogue are intended to insure the uniform quality of the products. With these manufacturers the endeavors of the organization are concentrated, while those of truck builders must necessarily be directed to a diversity of purposes, all of which may be of equal importance, but all of which are not



Russel Internal Gear Drive Rear Axles Completed at Plant and in Readiness for Shipping.

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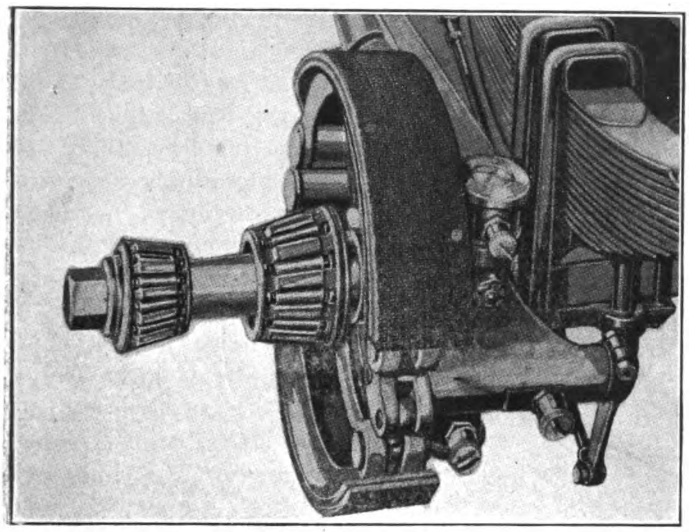
TRUCK BRAKES AND BRAKE LINING.

By EDWIN E. WAITE, Consulting Engineer, Standard Woven Fabric Co.

PERHAPS one of the most difficult problems the manufacturer of friction materials has to face is the one of truck brake lining. To the average man, as well as to a few engineers, brake lining is brake lining; the same as "Pigs Is Pigs." It seems any old



Internal Expanding Band Brake in Rear Wheel Drum.

brake lining is good enough. It is a fact, however, that it is as essential to have good brakes, well designed and properly lined, as it is to have a well designed and efficient motor. A well designed brake with a poor lining is often worse than a poorly designed brake with a good lining. If an article is no stronger than its weakest point, it stands to reason that a well designed brake, as well as a poorly designed one, should be lined with the best brake lining. We are constantly hearing of new motors—sixes, eights and 12s—in short, better motive power for cars and trucks; but how often do we hear of new brake designs, more efficient brake lining—the safety part of the car? If one of the pistons or valves leak or a cylinder skips fire on a multiple cylinder motor, it isn't to be compared to a brake not holding, yet how many of us are there that give the brake or brake lining a second thought until something happens?

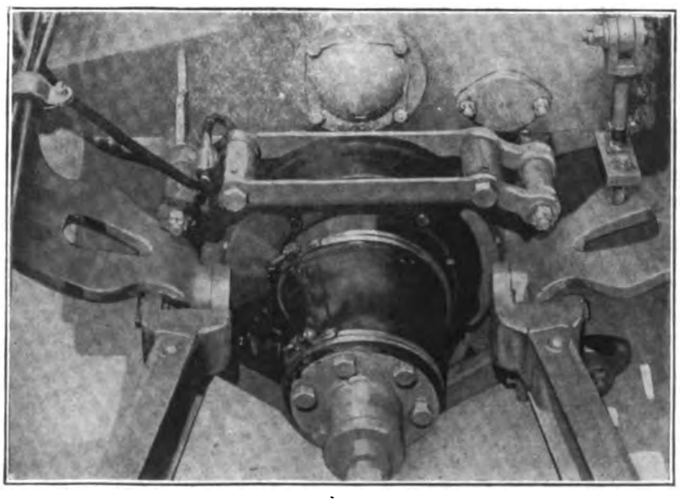
Last January the writer conceived the idea of having the S. A. E. look into and standardize the different sizes of brake lining, with the idea in view of having fewer sizes to contend with and have certain sizes recommended for given weights of cars. This is being done and we hope in the near future to be able to have the purchaser of cars and trucks know how much brake area; that is, length, width and thickness of brake lining his car or truck should have to be up to the S. A. E. standard. I believe it would be a good movement for the S. A. E. to work with some manufacturers of brakes and brake lining and determine the minimum clearance between brake lining and brake drum; standardize rivet spacings and sizes. I believe a car manufacturer or owner should be compelled by law to have brakes up to certain standards, just as they are compelled to have certain lights, numbers, etc.

Four Common Brake Types.

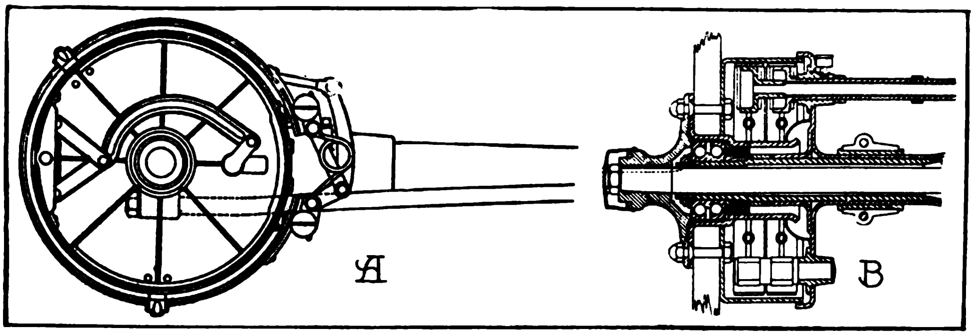
In motor trucks there are four common types of brakes; namely, rear hub external contracting, rear hub internal expanding, jack shaft or differential shaft external contracting and propeller or transmission shaft external contracting. These brakes are in turn divided into three sub types; that is, the locomotive type, full wrapping and semi-wrapping. Since the worm drive has been developed the tendency has been to have the service, or foot brake of the truck, on the propeller or transmission shaft and the emergency, or hand brake, on the hubs of the rear wheels.

Let us stop and consider the work that these brakes are called upon to do. The duty of the foot brake is to retard or stop the truck when desired, either through the crowded streets of the city or on the hills of the country. It is in constant use while the truck is in motion. On the other hand, the emergency brake is very seldom called upon to stop the truck and is generally used only to lock or hold the truck from starting after the service brake has brought the vehicle to rest. In short, the foot brake is the one very often that saves lives and property and has the greater amount of work to do.

Let us take a five-ton truck of a well known make and figure the work done by the foot brakes on the propeller shaft and the hand brake on the rear wheels. The gross weight of the truck is 20,000 pounds—service brake on the transmission shaft 10 inches diameter of brake drum by five inches width of face, locomotive type brake, using 81.4 square inches of lining. Hand brake on the rear wheels 19¼ inches diameter brake drums by five inches width of face, internal expanding



Contracting Brake on Forward End of Driving Shaft on G V Mercedes Trucks—This Brake Can Be Water Cooled.



Types of Double Rear Wheel Brakes: A, External Contracting and Internal Expanding Band on and in Rear Wheel Drums; B, Internal Expanding Shoes in the Rear Wheel Drums.

type, using 342 square inches of brake lining. The speed of the transmission shaft is 950 revolutions per minute. Say the foot brake is four times as powerful on the transmission shaft as it would be on the rear wheels, due to gear ratio.

Suppose for argument there is 75 per cent of the weight of the loaded truck on the rear wheels, which equals 15,000 pounds. Let us take the coefficient of friction between the rear wheels or lock them from turning and we should have a force at the periphery of the wheels to overcome equal to 4500 pounds. This means that on the hand brake we must have a force acting on the brake drums of 950 pounds, or 2338 pounds acting on the periphery of the foot brake drum.

What a Brake Lining Must Do.

Let us consider what the brake lining is called upon to do. It will be seen that the area of the hand brake is approximately 4.2 times the area of the foot brake. If the coefficient of friction between the brake lining and the steel brake drum is taken at 3/10 (which is the average coefficient of friction of the best grades of brake linings), it will be seen, since the coefficient of friction equals the total friction divided by the total pressure, that we will have to have a total pressure between the brake lining and the rear wheel brake drums of 31,133 pounds, or since there is 342 square inches of brake lining, we have a unit pressure of approximately 91 pounds per square inch. For the foot brake we have a total pressure between the brake lining and the transmission shaft brake drum of 7793 pounds. Since there are 81.4 square inches of brake lining used on the foot brake, we have a unit pressure of approximately 95½ pounds per square inch.

Before going further into the analysis of these truck brakes, let us consider what the brake lining manufacturer is called upon to do by the engineers. Here we have a foot brake lining that is called upon to do at least 75 per cent. of the work of controlling the truck, yet it has approximately 4½ pounds more pressure per square inch applied to it than the hand brake which works only 25 per cent. of the time. If the hand brake is correct for size and area of brake lining, it seems the foot brake is less than one-third large enough if we desire to have the same life or miles travelled by the truck for the two brakes.

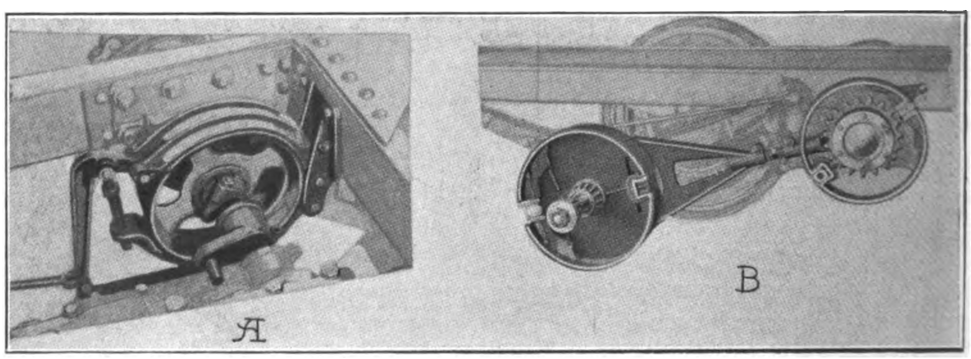
There comes to our attention at this point the surface speed of the brake drums and the effect upon the lining. If the transmission shaft travels 950 revolutions per minute and diameter of the drum is 10 inches, we have a surface speed for the foot brake drum of 2487 feet per minute. For the hand brake drum we have a surface speed of approximately 638 feet per minute. We find the foot brake lining called upon to brake a surface travelling nearly four times the speed of the hand brake. Consider well what this means.

If the brake lining drags (and there are some truck drivers that are always dragging the foot brake), it has a tendency to glaze. The coefficient of friction of the brake lining then drops off.. The drum is always kept hot and the poor service brake is called upon to do still more work. If the brake lining is made wider we have hard work to radiate the heat that is generated and a brake that does not heat in operation isn't a brake, but a bearing. The way the work of stopping the truck is dissipated is by converting the work into heat and then radiating it as fast as possible.

Without going into the technicalities of brake design and brake lining construction any further there are a few points I would like to bring to the mind of the reader. Wouldn't it be better to have two drums of normal width; that is, ones easily cooled and of small diameter, than one large diameter one with a wide face? It seems to me, after considerable study and testing, that for a good brake the drum should be small when used on the transmission shaft and large when on the rear wheels.

Here are a few points which must go to make up the perfect brake lining:

Uniform coefficient. (I mean by this a coefficient that does not raise and lower materially with varying speeds and heats, but one that will normally be, say, 3/10.)



Typical Truck Brakes: A, Locomotive or External Type Service Brake, Having Solid Metal Shoes That Clamp on Jackshaft Drums; B, Internal Expanding in Both the Jackshaft and the Rear Wheel Drums.

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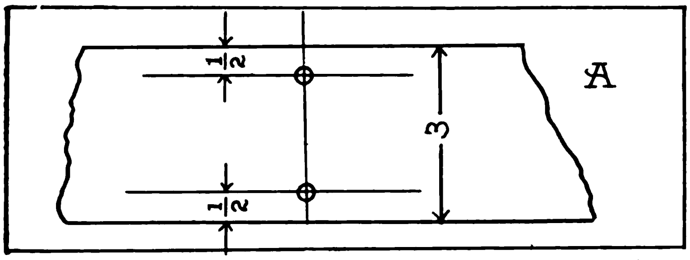
Heat resisting.
Oil resisting.
Life. (That is, wearing qualities.)



Brake Lining Rivets Spaced 1/6 of the Width of Fabric from Selvage Edge.

A brake lining must be free from any tendency to stick or gum the brake drum.

It should not give off an offensive odor when heated, should not grab; yet should stop the car when desired.

A high coefficient is not good, as any treatment that gives a high friction will grab, boil out of the lining when the brakes get hot and be apt to adhere to the brake drum when cooling. Another point in a brake lining that has a tendency to grab and soften under heat is the fact that the treatment acts as a lubricant to the brake drum when it is heated and the friction drops off, the lining glazes and we have the complaint of the brakes not holding. I believe that the service brakes, as well as the linings on trucks, should be carefuly studied and that the working pressure should be between 50 and 75 pounds per square inch. The coefficient at an average surface speed of 1600 feet per minute as near 3/10 as can be obtained.

Spacing the Lining Rivets.

The linings should be firm, but not brittle, so as to hold the rivets that fasten the brake lining and bands together. I have found it a good practise to space rivets as follows:

The distance from the selvage edge of the lining to the centre line of the rivets one-sixth the width of the lining; that is, if you were to put on a three-inch piece of lining the distance from the selvage edge should be ½ inch, as in the illustration, Fig. A.

In order to have the same strength upon the cut end of a piece of brake lining to the centre line of rivet as from the selvage edge to the centre line of rivet, the distance should be one-third the width of the lining, or twice the distance from the selvage edge, as in illustration Fig. B.

Do not get the rivets too near the edge. Remember the brake lining is a fabric, made from yarn about 3/64 inch in diameter, and in order to get strength a certain amount of fabric must be on the outside of the rivet.

Need of Brake Adjustment.

Adjustments of the brakes should be looked after just as carefully as the adjustment of the motor. A man will tinker and fuss for days on his carburetor to save a few cents, yet he will never look at his brakes or brake linings, which might save his life or the lives of others. Keep your brake linings clean and well adjusted. I have noticed trucks with brake shoes so designed that the lining dragged continuously upon the drum and the maximum contraction was only .02 inch on the diameter of the drum. I do not feel that this is enough to take care of the compressibility, wear and clearance of the lining. The brake linings should be clear from the drum at all times when not in use and when applied should hug the drum uniformly.

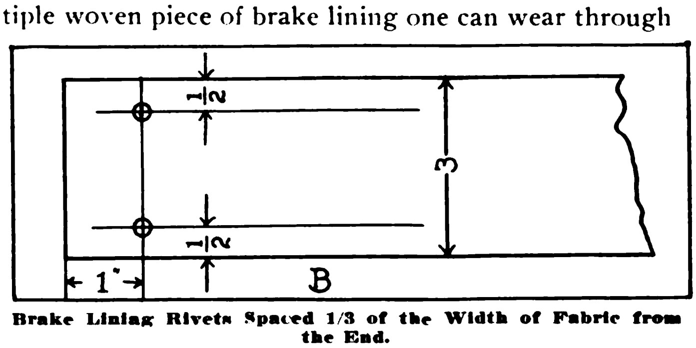
I do not consider that the proper place for the service, or foot, brake is under the body where it is never seen, where it is always hot, hard to adjust, hard to keep clean and where the surface speed is so great. If it is essential to brake the transmission, why not have a small brake for that purpose and keep the important brakes on the rear wheels where they can be looked after more easily. Why not have the foot brakes made in proportion to the hand brakes as to their service?

Why is it that some car manufacturers that have used the transmission brakes have gone back to the rear wheel brakes, and vice versa? When we consider that truck brake lining, like pleasure car lining, is made from a woven fabric, it seems remarkable that the lining will stand the work that it is called upon to do.

What Brake Lining Is Made From.

Just a word about the way that the woven asbestos fabric is manufactured. Most of us are aware that the asbestos rock is taken, crushed into fiber, spun into yarn and then twisted with brass or copper wire, according to the different specifications of brake lining manufacturers. This yarn is then put into the looms and woven much in the same way as all narrow fabrics are woven. After the goods are woven they are treated in various ways to give the fabric frictional qualities as well as life. A good many manufacturers, more specially those making the best grades of brake lining, weave their fabric in plies, what is commonly known as "solid multiple weaving." For example, a piece of lining 1/16 inch thick would be one single ply; ⅛ inch, two-ply; 3/16 inch, three-ply; ¼ inch, four-ply, etc. These plies are bound together by binder threads which go through the fabric from back to front, binding it into one homogeneous mass.

It can be very readily seen, then, that with a multiple woven piece of brake lining one can wear through



Brake Lining Rivets Spaced 1/3 of the Width of Fabric from the End.

the first ply and still another ply remains to be worn through, and so on down until the last ply is reached. The last ply is very rarely worn through, because at

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this point, if the work should become excessive instantaneously, the lining would be very apt to tear from the rivets and a serious accident might occur.

On the cheaper grades of linings (these that we designate as being bought on price alone) we find that no matter whether the lining is ⅛ inch, ¼ inch or ⅜ inch, it is still two-ply. The way this is accomplished is by putting in what are commonly known as stuffers. These stuffers are no more or less than straight yarn laid in between the two plies and do not weave. As soon as the first ply is worn through these stuffers are free to come out; no amount of riveting could possibly hold them in, and our brake lining is gone. This is why a ¼-inch piece of lining made with stuffers would be much cheaper than a ¼-inch piece of solid woven four-ply material.

In one case the buyer of a stuffed fabric ¼-inch thick gets 1/16-inch of wear. There are 3/16 inches wear that should be gotten if it were a four-ply piece of goods. Therefore, there is ⅛-inch or three-quarters of the lining that is practically useless; while, on the other hand, if the ¼-inch piece of goods were made four-ply and wore through the first ply, you come to the second, you wear through the second and you still have the third. When wearing through the third ply the brake lining is in the same practical condition that the brake lining was that was made with stuffers and had been worn through the first ply. In a two-ply piece of goods showing eight picks on the face of the cloth, the shuttle must travel back and forth 16 times to make one inch, while on a four-ply piece of goods showing eight picks on the cloth the shuttle must travel 32 times across to make one inch of fabric. The labor cost of manufacturing a four-ply piece of cloth that gives three-quarters of its thickness in wear. is twice as much as that of a piece of lining that only gives one-quarter of its thickness in wear.

I trust that some of these points that I have mentioned will be taken up and discussed by the various readers of this article; that the Society of Automobile Engineers will look into the various properties and requirements of lining and tabulate formulae whereby the busy engineer who has not time to go into the detail of brake construction and brake lining will be able to design an efficient brake and recommend an efficient brake lining for use on his trucks.

PACKARD SURPLUS GROWS.

Greatly increased manufacturing facilities at the Packard plant are shown in the annual report of President Joy to the stockholders. The company's revenues of all sorts for the year ending Aug. 31 amounted to $16,325,722, and the company's disbursements to $16,499,075, including large expenditures for improving the plant. Cash on hand Aug. 31 amounted to $2,289,111, against $2,462,464 a year ago. The surplus was $3,713,747, a net increase of $1,915,926 for the year.

TRACTORS FOR GARBAGE HAULING.

Two four-wheel tractors, drawing new type double-decked garbage and waste collection semi-trailers, are now in use in New York City. The trailer has a top or deck for the body on which may be carried barrels, boxes and waste of various sorts, and underneath this are compartments for garbage and ashes.

The lower bins are filled from the side through doors which open only while buckets are being emptied through them, which automatically close. This manner of loading obviates the dust being blown about by the wind and makes for much cleaner and more sanitary collection and haulage.

Twelve of these outfits have been ordered and the crews which will operate them are now doing experimental work with the two already in service to determine the most efficient methods of handling the loads. At the dump the receptacle in which the load is carried is lifted off the trailer by a crane and emptied.

With one of these tractors and trailers the work for which five of the old style garbage collection carts were required can be done. Each one will be operated by a crew of five men. The machines will be used between Sixth avenue and the East river in the district between 14th and 42nd streets. The cost of each tractor and trailer is $5000. The tractors can be detached and can be used to haul snow plows, sweepers or any other implements that the departments may desire to use with them.

37,000 TRUCKS MADE THIS YEAR.

Every truck manufacturer in the country has been running to capacity for several months, but many of them will not divulge the extent of their output. A man in very close touch with the situation estimates it at 37,000.

There is every indication that next year is to see a great increase. Three manufacturers of internal drive gear axles say they have on their books orders for 15,000 axles on which definite delivery dates have been specified. Manufacturers of internal gear drive axles during the past few months have more than doubled their factory capacity.

MOVING COLUMBIA TRUCK FACTORY.

The Columbia Commercial Car Company, which is moving its plant from Kalamazoo to Pontiac, Mich., already has transported much of its machinery. Work is to begin as soon as possible as the company has an order for 50 trucks for early delivery.

A strike has tied up the big automobile and truck body plant of Theodore Kundtz in Cleveland, O., which has been making thousands of bodies for Cleveland truck and car firms that have been turning out trucks for the allies.

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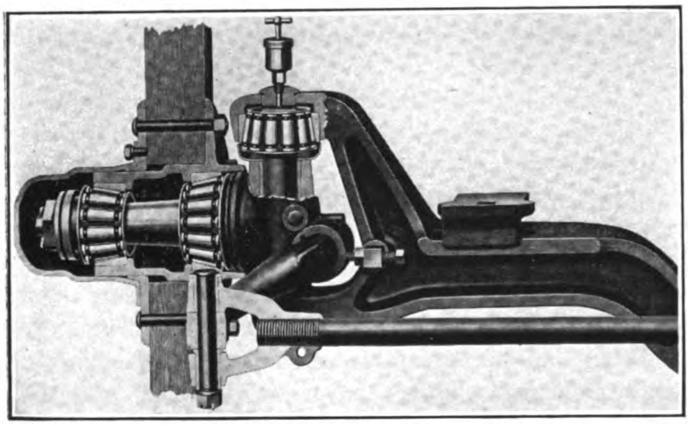
TIMKEN ROLLER BEARINGS IN TRUCK SERVICE.

By FRANK N. SIM, Advertising Manager, the Timken Companies.

STRENGTH and flexibility in the parts that carry the load make the commercial car a practical possibility.

To be commercial a motor truck must give uninterrupted service over any road—10 hours a day—every working day in the year, and its use-service-value de-



Front Axle Spindle and Steering Knuckle Pivot Equipped with Timken Roller Bearings.

pends absolutely upon the rightness of its component parts.

No parts are more important to the truck owner than the bearings—because they safeguard the other vital moving parts that give life to the car.

Where are good bearings needed in a motor truck?

On the axle spindles, in the hubs of all four wheels, in the steering knuckle heads, in the transmission, on the worm shaft, each side of the differential—these are the hard service places where only the best bearings will stand up to year after year use.

All good anti-friction bearings reduce friction almost to the vanishing point, but reducing friction is perhaps the least important factor in bearing construction. The bearings in a motor truck must sustain the vertical load and the sudden increases in that load that come with rapid travel over rough road surfaces. They must meet severe end pressure along the line of the shaft—a force that often exceeds vertical load.

Weight of the truck and its freight, pressing down on the wheel bearings, is a good example of vertical load. "Mass momentum" of truck and contents, pressing sidewise against the wheels as you round a corner, is a good example of end thrust. Keep both vertical load and end thrust in mind as you read further.

Wheel bearings must turn easily of course—to eliminate friction. But they must fit snugly, too, to prevent wheels from wobbling.

How Bearing Wear Is Manifested.

As bearings wear—all bearings do—they get loose. A little looseness allows the pound that makes faster and faster wear—more and more looseness.

Unless the bearing is of a type that can be adjusted to take up the looseness, nothing can prevent the effects of that looseness—except to replace the bearing with a new one.

Bearings on shafts that support gears—transmission, driving and differential gears—when they wear (as all bearings do) allow the shafts to drop slightly out of line. The gears on those shafts get slightly out of correct mesh. Imperfectly meshed gears make noise and waste some of the power. Here, too, the looseness allows pound, pound increases the rate of wear, brings more and more looseness and lets shafts drop still more out of line, gears still more out of true mesh.

The trouble goes on **at an increasing rate** unless it is promptly checked by adjusting a type of bearing that can take up the looseness when it develops.

It would be ridiculous to claim that any bearing does not wear as its parts revolve under the heavy loads, shocks and vibrations of road service in a motor car.

Use of steels best adapted for bearings, extreme accuracy of manufacture, strict following of heat treatment formulas developed by years devoted to concentrated study of bearings alone—these are producing bearing parts that have wonderful wear resisting qualities.

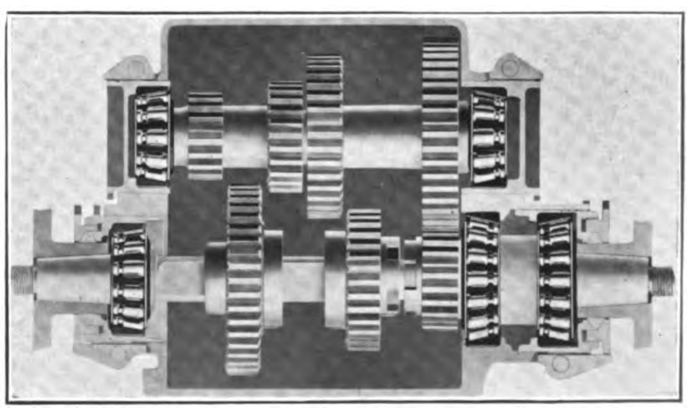
And yet bearings—all bearings—do wear.

Adjustability of Timken Bearings.

The Timken tapered roller bearing is the one type of bearing that can be adjusted to completely eliminate the effects of its slight wear.

Adjustment puts the parts back into the same relation to each other as when the bearing was new—restores to the full its unique principles of efficiency.

The Timken tapered roller bearing carries the load and resists the shocks along the lines of its rollers instead of on the points of balls; its tapered construction enables it to meet side pressure and shocks in ad-



Typical Transmission Gearset Shafts Mounted on Timken Bearings to Take Radial and Thrust Loads.

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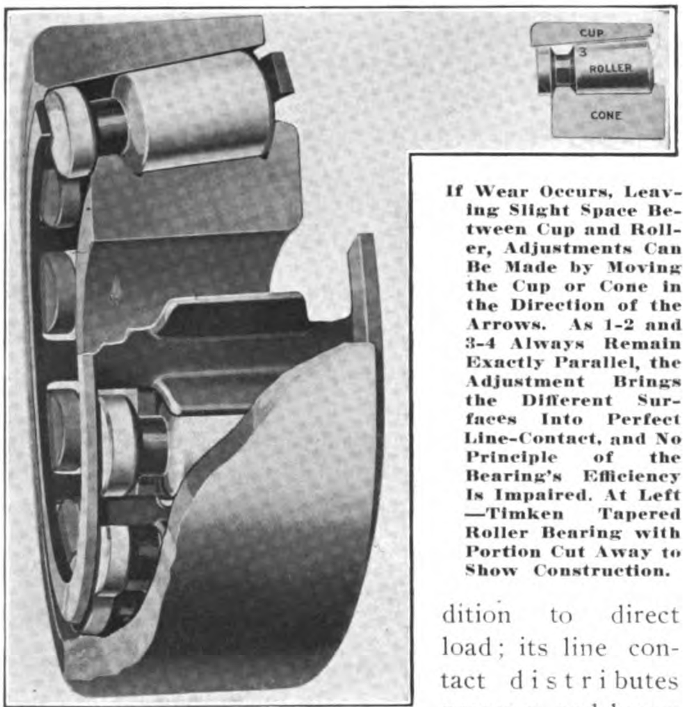


If Wear Occurs, Leaving Slight Space Between Cup and Roller, Adjustments Can Be Made by Moving the Cup or Cone in the Direction of the Arrows. As 1-2 and 3-4 Always Remain Exactly Parallel, the Adjustment Brings the Different Surfaces Into Perfect Line-Contact, and No Principle of the Bearing's Efficiency Is Impaired. At Left—Timken Tapered Roller Bearing with Portion Cut Away to Show Construction.

dition to direct load; its line contact distributes pressure and hence minimizes wear—these are three great principles that are kept in constant operation for your benefit by the fourth great principle of adjustability.

And beyond keeping the Timken bearing itself always at full efficiency, its great principle of adjustability keeps the shafts and gears, that depend on bearings, up to their top-notch efficiency.

Stresses on Wheel Spindle Bearings.

A five-ton truck itself weighs about 8000 pounds, its load 10,000 more. The whole of this immense weight is supported by the spindles of the front and rear axles.

The 18,000 pounds rest, too, on the bearings that fit over the axle spindles—two bearings on each spindle, eight in all. And in a Timken-Detroit axle these are Timken tapered roller bearings that carry the load along their whole length, not on mere points as ball bearings must.

So the 18,000 pounds rest really on the rollers, and not on all of them either, because only one-fifth of those rollers are under the load at any one time. Actually 18,000 pounds on 24 rollers—an average 750 pounds to the roller—twice that on some—and the rollers average 5/8 of an inch in diameter.

And mere weight isn't all—isn't even half. Hammer blows due to jolting over rough roads, and side pressure when corners are turned often exceed weight! The bearings are constantly meeting all of them at once!

Yet even this is not all! It is only what the axles and bearings meet under ideal conditions. What about emergencies? Careless driving, overloading, the hundred and one extraordinary stresses that the truck must meet, and meet every day.

You can't count on your driver as you could on yourself. You can't be sure he won't travel at excessive speed, take chances, cut corners, back too hard against the curb.

Axles and bearings have to meet these emergency requirements. They are inevitable in motor truck service. They must be anticipated in truck axle and bearing design.

Need of Good Transmission Bearings.

Let us consider for a moment the further importance of good bearings in the transmission of a commercial car.

It's not power at the motor, but power where rear wheels touch the ground that makes your motor truck go.

When the car is running on anything but direct drive there is bound to be some loss of power in the transmission from friction—friction in the bearings and friction between the teeth of the gears.

Any good anti-friction bearings, properly mounted and lubricated, almost entirely eliminate bearing friction. Gear teeth of the right shape, if well lubricated, hold gear friction to a minimum, providing shafts are in perfect alignment so the teeth mesh perfectly.

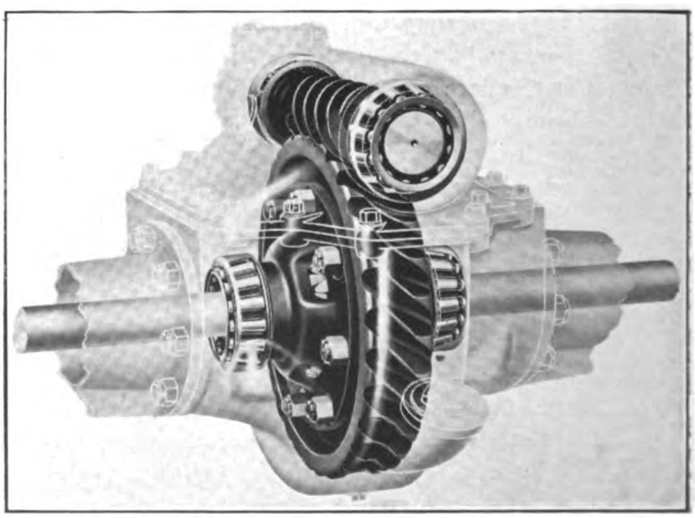
It is the transmission builder's task to get shafts in line when the transmission is new. Keeping them in line afterward depends largely on the bearings.

With Timken adjustable bearings the transmission can be kept tuned up to its top notch efficiency as the car grows old in your service. Tuned up to the point where it continuously transmits the maximum of the engine's power toward the place, down behind, where that power does useful work for you.

The Work of Worm Shaft Bearings.

With the advent of the worm drive for motor trucks, anti-friction bearing manufacturers were confronted with the hardest problem they were ever asked to solve. The ultimate success, durability and economy of this simplified method of power transmission depended absolutely on a type of bearing capable of taking the constant end thrust of the worm plus vertical load.

Some bearing makers tried and failed. Some succeeded for a short time and then hard service showed up the weak spots in their design. Timken made good from the start and bearings that went into service over



Worm Gear and Shaft of a Timken-Detroit Axle Fitted with Timken Roller Bearings.

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three years ago are still on the job.

The bearing behind the worm in any worm drive axle gets the constant punishment of two opposing forces—radial load and end thrust.

The first exerts a direct downward force on the bearing, while the second operates simultaneously at right angles to the direct load, exerting a side pressure known as end thrust.

Motor car engineers admit that the hardest place for a bearing to make good in worm drive work is behind the worm—because in addition to the direct or radial load it must also sustain the thrust load imposed, as the power from the engine causes the teeth of the worm to turn in mesh with the teeth of the worm wheel.

There is only one type of bearing used in worm drive axle construction that has successfully withstood both these forces at the same time and that is the Timken roller bearing used in Timken-Detroit worm drive axles.

In over three years of use on commercial cars in the hardest kind of service Timken bearings have never failed to successfully fulfill the exacting requirements of worm drive work.

KISSEL TRUCK DROPPED 25 FEET.

A KisselKar truck used to haul packing boxes near Lewiston, Me., recently dropped 25 feet through the floor of a bridge. It did not tip, but lighted on all four wheels. The two passengers were badly shaken up, but not injured.

The body of the truck was broken, the frame sprung about six inches and the radiator damaged. But when the car was taken out of the water and the radiator patched it was run to the repair shop in Lewiston on its own power. The axles and springs were intact. This was a remarkable test of the sturdiness of the vehicle.

WILL BUILD NEW FARM TRACTOR.

The Townsend Manufacturing Company of Beloit, Wis., will shortly put in the market a new gasoline tractor designed for general purposes in both city and farm work. The engine is rated at from 10 to 20 horsepower. The machine may be used for plowing, seeding, cultivating and similar work, as well as for filling silos and hauling farm loads. The machine in a recent test handled three 14-inch plows in sod that had not been plowed for 40 years, and which averaged from eight to 11 inches in depth. The cost was 11.2 cents an acre for fuel and 3.5 cents for oil and grease.

The Porter Rubber Company has been organized in Salem, O., with capital of $125,000, and is about to erect a plant. The officers are: President, J. C. Porter; vice president, T. H. Boyd; treasurer, E. E. Boyd.

INTERNATIONAL MOTOR PROSPEROUS.

The International Motor Company, New York City, is now extremely prosperous and its operations will show a profit of $1,000,000 for the calendar year of 1915. This is equal to 28 per cent. on the $3,600,000 preferred stock outstanding.

Business was poor during the early part of the year and did not improve until March. Since then large orders have been received from the Allies and there has been a decided improvement in domestic sales. The company manufactures and sells Mack and Saurer trucks. Demand has been so far ahead of production in recent months that many departments have been operating day and night.

The high record for one month's operation recently resulted in a net profit of $125,000, or at a rate of $1,500,000 per annum, which is 42 per cent. on the preferred stock. The preferred stock, which is cumulative and has paid no dividends since the fall of 1912, will have due upon it at the end of this year 21 per cent. There is outstanding $5,628,125 of common stock on which no dividends have ever been paid.

The company is now in the best financial condition that it has been in for years. All interests have been harmonized and several suits which were begun some months ago have been withdrawn.

MOTOR AMBULANCES FOR ARMY.

The surgeon-general of the United States army has ordered the convening of a board to ascertain what type of ambulance had best be adopted. The board will consist of Major A. W. Williams, Captain Percy L. Jones, Captain Arthur W. Christie and all of the medical corps on duty in the vicinity of Washington. There are about 20 automobile ambulances in service now, all of them being equipped with the standard type of ambulance body. This does not mean, however, that exclusive dependance is to be put upon motor ambulances, as there are many localities in which it is believed they cannot be used successfully as yet owing to road conditions.

TOWER TRUCK IS BROUGHT OUT.

R. J. Tower of Greenville, Mich., has organized the Tower Truck Company and is bringing out the Tower truck. The first machine was recently completed in Tower's foundry and machine shop. It has a Continental motor, Timken axles and a 135-inch wheelbase.

Wilbur C. Johnson, vice president and sales manager of the Waverly Company of Indianapolis, Ind., has been elected secretary of the Electric Vehicle Manufacturers' Association. He succeeds E. P. Chalfant, who has resigned to join the Anderson Electric Car Company of Detroit as eastern manager.

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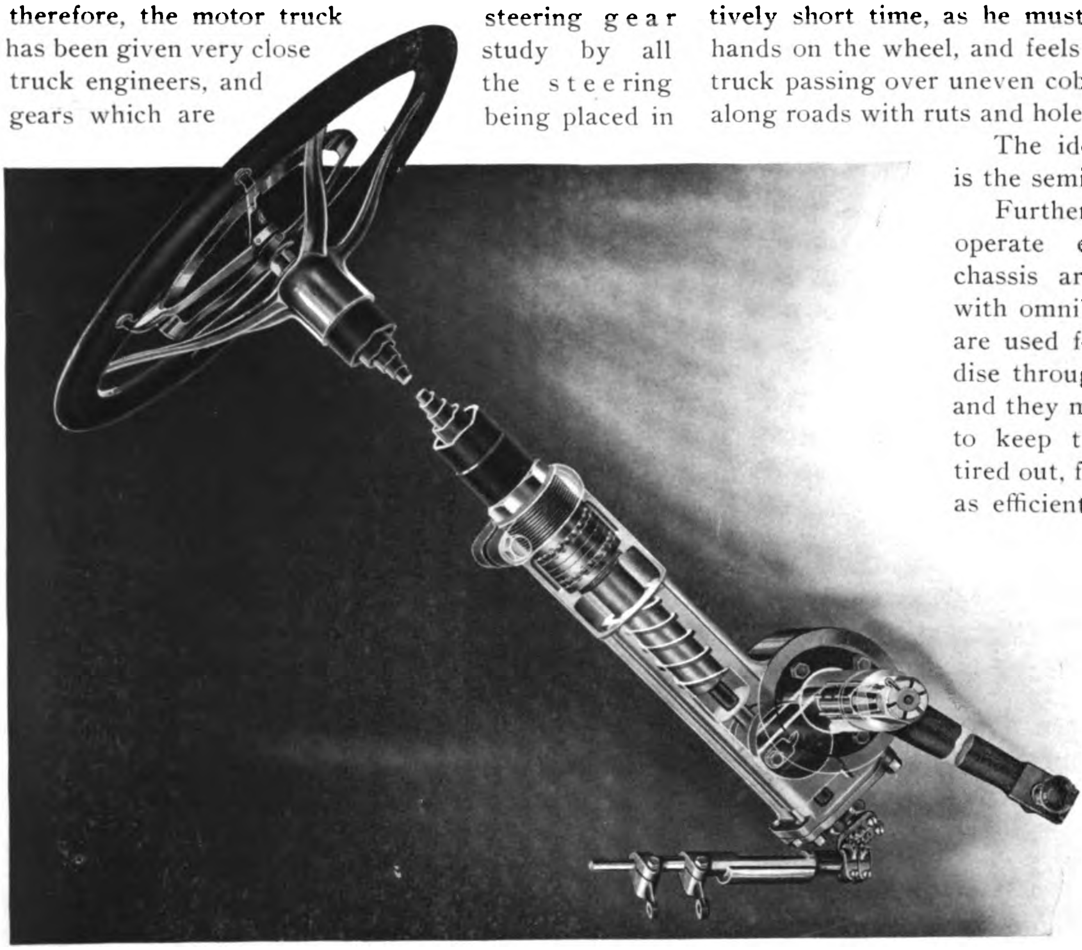
ESSENTIALS FOR STEERING GEARS FOR TRUCKS.

By EDWARD A. ROSS, Secretary Ross Gear and Tool Company, Lafayette, Ind.

THE importance of a steering gear as a component part of the motor truck cannot be overstated. In motor truck design there are only two units which depend upon the physical efforts of the driver. One of these is the brakes, and the other is the steering gear.

Faulty brakes may be the cause of a grave disaster and a faulty steering gear can cause more damage than any other defective component in a motor truck, and, therefore, the motor truck steering gear has been given very close study by all truck engineers, and the steering gears which are being placed in motor truck chassis at the present time are, for the most part, the result of many experiments and many years experience in the actual building of steering gears.



The Construction of a Ross Steering Gear, Showing the Nut That Completely Encircles the Screw, Affording Exceptional Strength and Endurance.

The fact that the steering gear is manually operated all the time the truck is moving makes it essential that it operate so that the driver will use the least effort. In the design of motor trucks a great deal of consideration must be given to the comfort of the driver. He must not be exhausted by the necessity of operating a steering gear through which he can feel every rut in the road. Years of experience have taught designers that the most practical steering gear for a truck is one which is semi-irreversible. The steering gear itself must absorb a great many of the minor shocks and a per cent. of the larger shocks. It must not be absolutely irreversible, as the stresses on the steering knuckles and the link connections would be too severe if it were, and would cause fractures which might be fatal.

Reversible Gear Hard for Driver.

On the other hand, a steering gear which is perfectly reversible will exhaust a driver in a comparatively short time, as he must constantly keep both hands on the wheel, and feels all of the shocks of the truck passing over uneven cobble stone pavements, or along roads with ruts and holes in them.

The ideal condition, therefore, is the semi-reversible gear.

Furthermore, the gear must operate easily. Motor truck chassis are now used frequently with omnibus bodies in cities, and are used for delivery of merchandise through crowded city streets, and they must steer easily in order to keep the operator from being tired out, for a tired operator is not as efficient as one who is not exhausted by keeping his truck from running into other vehicles, or from being run into. He can have a clearer head and take care of the loading and unloading and will treat the truck better if it does not wear him out.

Another essential of truck steering gears is that they must be extremely durable. A gear which will develop an excessive amount of lost motion in the steering wheel is not safe. In order to obtain long wear, a steering gear must be a perfectly balanced design. There is no object in designing a steering gear with a tremendous surface between two moving parts, when the surface between two other moving parts which perhaps have equally as much, or more, to do, is inadequately small. A steering gear will wear only until the surfaces, which will wear out first, have worn to a point where steering is not safe. It is not good design or good practise to build a steering gear for a truck in which all of the parts will have long life, except, perhaps, one, and expect the operator of the truck to make a repair on the gear when this one

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part is worn out.

Materials Must Not Wear Prematurely.

The materials used must be chosen with a view to this wearing feature, and frequently they must be heat treated and present ground surfaces which will not wear out prematurely. A truck steering gear which requires adjustment to keep it in good condition, is, obviously, not as good as one which does not require adjustment.

Another very important feature of truck steering gear design is that of good lubrication. The steering gear is located underneath the hood, in a difficult place for the oiler to reach, and it must be so designed that the oil can be put in with the least possible trouble, and will reach all of the moving parts of the steering gear. Therefore, the essentials of good truck steering gear design are easy steering, long wear and good lubrication.

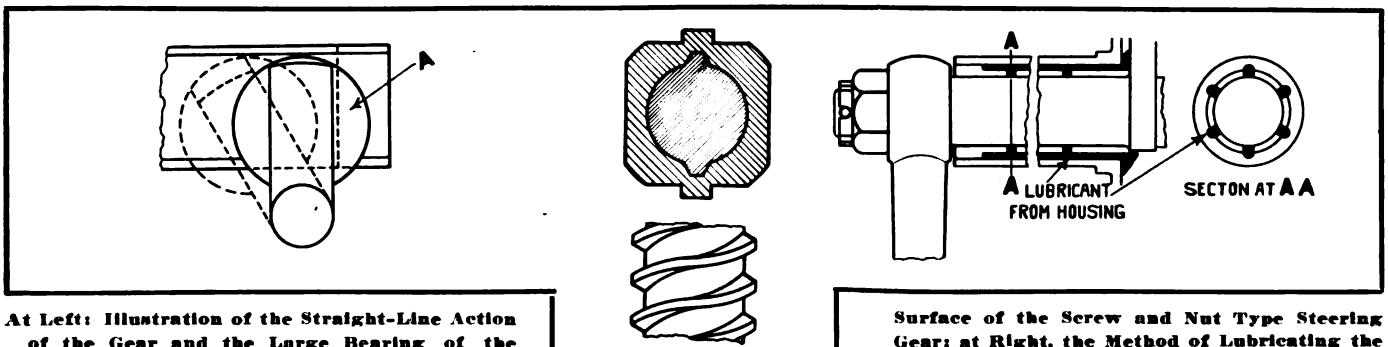
Factors That Make for Long Wear.

To go back to the essential of long wear, it is an undisputed fact that two surfaces moving against each other will outlast a line contact, and that a large surface is better than a small surface; therefore, I believe that the screw and nut type gear is, due to its design, essentially better than any other type, as it presents more bearing surface than any other type.

The illustration accompanying this article is of a design which permits more bearing surface between the moving parts than any other steering gear made. It is of the screw and nut type. The nut is a solid piece, completely enveloping the screw, and, therefore, the threads in the screw are in constant and complete engagement with the threads in the nut. The screw has a rotary motion and the nut has a longitudinal motion. The means of transmitting this longitudinal motion of the nut to the rotary motion of the steering arm is by the circular discs shown at the lower end of the nut. These discs present enormous constant bearing surfaces to the recesses in the nut. The discs are provided with slots, into which fit the projecting levers from the rocker shaft. At this point, also, the bearing surface is tremendous. All of these surfaces are ground, and the wear between them has proven to be inappreciable after thousands of miles of hard service on motor trucks.

With respect to the steering gear shown in the illustration, taking up the essential of "Easy Steering," note the straight line action of the working parts of the gear. The screw pulls the nut up or down in the housing, and there is no tendency for this nut to be moved sideways or to become cocked. The levers projecting from the rocker shaft into the swivels which rotate in the lower part of the nut are in direct line with the screw, so that the push and pull of the nut is an absolute straight line. This gives a steering gear of high mechanical efficiency, which gives easy steering.

As regards "Lubrication," I have shown in the illustration the method of lubricating the rocker shaft from the oil which is in the main housing of the steering gear. This is accomplished by six longitudinal grooves in that part of the housing which surrounds the rocker shaft. These grooves do not extend to the outer end of the rocker shaft, or the oil would run on out. With the construction as it is shown, the oil passes through the grooves and through holes in the bushing surrounding the rocker shaft, which are in line with the grooves, so that as long as there is any oil in the main housing of the steering gear, the rocker shaft is lubricated. This is ordinarily the most difficult part of the steering gear to keep lubricated, and the method described and illustrated herein is entirely satisfactory and successful.



At Left: Illustration of the Straight-Line Action of the Gear and the Large Bearing of the Filling Piece A; at Centre, Note the Large Surface of the Screw and Nut Type Steering Gear; at Right, the Method of Lubricating the Rocker Shaft.

MOTOR TRUCKS IN CANAL ZONE.

Two motor delivery trucks have been placed in the service of the Ancon, Canal zone, commissary store for making deliveries of goods to quarters. A third is ready to go into commission and five others are on order in the United States. The supply department has ordered a three-ton and 1½-ton truck for its heavy hauling and several other departments are considering the replacement of their horses with motor wagons.

GARFORD MEN STUDY WORM DRIVE.

Fifty Garford truck owners and the Garford organization in eastern Pennsylvania gathered at the Garford Philadelphia company's sales rooms at Philadelphia, Penn., recently for a study of the worm drive. They were addressed by E. A. Shelley, advertising manager of the Sheldon Axle Company.

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ECONOMY AND ENDURANCE OF GOOD PAVING.

IN VIEW of the excellent results which many states are securing from the construction of brick roads, the United States Department of Agriculture has issued an exhaustive bulletin giving general information for public officers who have charge of pavement construction.

Brick roads, the bulletin states, have three important advantages. They are durable under all traffic conditions; they afford easy traction and a moderately good foothold for horses; they are easy to maintain and cheap to clean. The chief disadvantage is that they are more expensive to construct, and in many cases the effort to reduce the high first cost has led to the construction of inferior pavement.

The cost of brick pavements depends upon factors so variable that no effort is made to give approximations, but instead a formula is suggested by which cost can be estimated when the price of material delivered to the job and of labor are known.

The bulletin discusses the different kinds of material from which brick are made, the manner in which these are taken from the earth and the processes by which brick manufacture is carried on. It describes, too, tests that can be made of brick to be sure of their quality.

Among the qualities that good brick must have are uniform size, reasonably perfect shape, toughness or resistance to crushing, hardness or resistance to abrasion, and uniform grading, that all parts of the pavement will wear at about the same rate. The crushing strength of good paving brick varies from 10,000 to 20,000 pounds the square inch, but since they are seldom subjected to stresses of greater than about 2000 pounds, this is of small consequence.

The most important trial for quality of brick is what is known as the rattler test. In this the bricks are subjected to destructive influences similar to those they have to withstand in actual use, and the effects resemble those which traffic may be expected to cause upon the completed pavement. The test is made by enclosing 10 dried bricks in a steel barrel with a number of cast iron spheres. Ten of these spheres weigh 7½ pounds each. Enough smaller ones weighing a little less than a pound are added to make the total weight approximately 300 pounds. The barrel is then revolved at the rate of 30 revolutions a minute for an hour. At the end of that time the bricks are taken out and weighed and their loss in weight during the test is ascertained. In this test a good paving brick will lose from 18 to 24 per cent. of its wieght. In drawing specifications for brick for a road, it is desirable to fix the minimum as well as the maximum loss of weight from a sample by this test to insure against too great a difference between the softest brick that may be acceptable and the hardest that may be supplied.

The four essentials of a good road bed on which the brick are to be placed are good drainage, firmness, uniformity in grade and cross section, and adequate shoulders. Where drainage can be obtained in no other way it may be necessary to lift the road considerably above the surrounding land.

If the ground has been properly drained firmness is secured by making certain that the road bed is thoroughly compact. The sub-grade must be repeatedly rolled and reshaped until the desired grade is secured. The shoulders should never be less than four feet wide and not infrequently one shoulder is made sufficiently wide to form an earth roadway parallel to the brick pavement. Strong curbing is necessary for all brick pavement to prevent marginal brick from becoming misplaced. Portland cement and stone are the best materials for curbing.

Unless the foundation is evenly firm, some of the bricks will be forced down below the others. If the traffic is light a foundation of crushed stone, similar to that used for macadam, may be used, but if heavy traffic must be carried a concrete base is necessary. Above the concrete base a sand cushion 1½ to two inches thick is used to compensate for inequalities in the surface of the concrete and make the brick surface level.

This should be clean, dry sand, and should be gone over carefully to remove all undesirable material. Bricks are laid upon it and rolled with a steam roller. Joints between the bricks are filled with some material such as a grout made from Portland cement and sand, which will prevent the edges of the brick from chipping.

On top of the pavement a layer of sand should be placed to prevent the grout drying too rapidly and the road should be kept in that condition, closed to traffic, for 10 days. To prevent the pavement being noisy expansion cushions made of layers of bituminous materials should be placed along the curbs.

Brick pavement in America has hitherto been used chiefly for city streets, the first having been laid in Charleston, S. C., in 1872. The early work was usually improperly laid and did not have long life. Exceptionally fine results from a great many brick pavements in various parts of the country prove, however, that this paving is very enduring and economical if properly laid.

A 10 per cent. increase in wages has been given to machinists employed by the Kelly-Springfield Motor Truck Company, Springfield, O. About 400 men received the advance.

An order of 100,000 five-point Bethlehem spark plugs was recently shipped to the war departments of three of the European governments now at war.

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THE DEVELOPMENT OF THE INTERNAL GEAR DRIVE AXLE IN THE UNITED STATES.

By VIGGO V. TORBENSEN, President Torbensen Gear and Axle Company.

OF MOST absorbing interest to auto truck manufacturers and users today is, without doubt, the problem of final drive.

Nearly everything else connected with a truck—motive power, speed change gearings, tires, springs, ignition, control, etc.—has been handed down to them from the automobile pleasure vehicle industry, almost perfectly developed and ready for use, or nearly so, and the manufacturer of commercial vehicles had but to increase dimensions here and there, where called for to stand the increased strain imposed, and a very serviceable truck was the result.

The final drive, however, proved an exception to this. The full-floating or semi-floating axle, so universally successful in automobiles, is not the best construction for carrying heavy loads on hard tires, and even if heavily built and reinforced, it takes no expert to point out its weakness as compared to the solid forged dead axle.

The dead axle, moreover, required the use of side chains, and these, although right enough in theory, had even greater objections than the built-up hollow axle. The problem, therefore, was to retain the solid forged axle as a load-carrying member, with the floating axle as the power transmitting element.

The writer of this article, along with many others, early foresaw the coming of the power wagon and its development into an important industry, destined to rank with the largest the world has ever seen, and as early as 1901 attacked the problem of developing a satisfactory means of transmitting the power to the rear driving wheels.

To combine the two elements, the "dead" and the "live" axles into a compact and self-contained unit, the use of the internal gear at once suggested itself as the best means to that end.

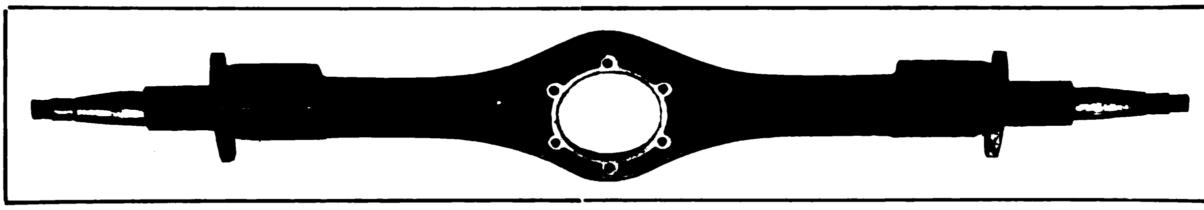

Fig. 1—The Load Carrying I Beam of the Torbensen Rear Axle, Which Is Drop Forged from Special Metal, Insuring Great Strength and Lightness.

It was tried out first on a small runabout in 1901, and in 1903 a truck was built in which the first drive was by internal gear directly attached to the wheels, and with the driving member a semi-floating axle or jackshaft external to, close behind and securely attached to the dead axle.

In this construction, the driving member formed a component part of the axle unit, and was not dependent on the use of any auxiliary member, such as subframe or torsion rods to hold it in position in relation to the wheels and dead axle. In this way, the driving pinion and the driven internal gear were always working on rigidly fixed centres in absolute parallelism. The result was an almost noiseless drive, efficient enough to satisfy the most exacting.

The experimental axles mentioned above are believed to be the first practical application of internal gear drive to commercial vehicles in this country. The original drawings are still in existence, but will not be shown in this connection, as they are now only of historic interest, although in the further development of this system of final drive it is interesting to note that

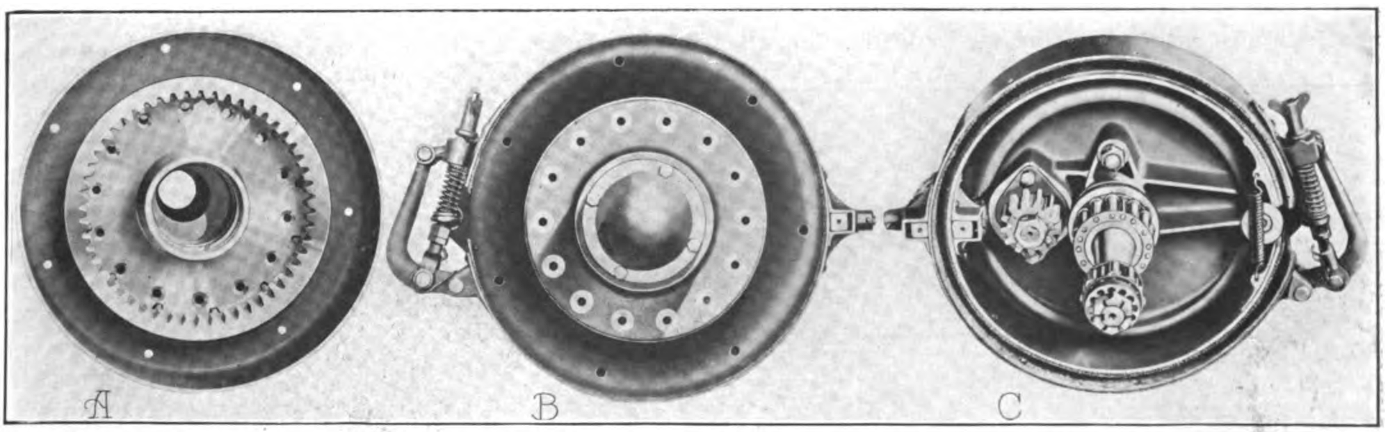

Fig. 2—A, Wheel Hub, Brake Drum and Internal Gear of the Torbensen Rear Axle; B, the Brake Drum and Service Brake Assembled; C, End View of Axle with the Driving Pinion in Place.

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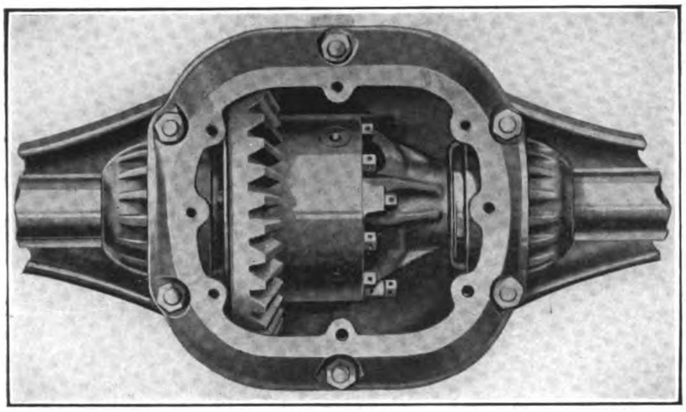

Fig. 3—The Differential Housing with the Cover Plate Removed, Showing the Gear Assembly.

its progress has undoubtedly been due to the original principle of keeping the jackshaft an integral part of the axle unit.

During the next six or seven years following these early experiments, there took place an enormous development of the pleasure car industry, and in the rush to keep pace with it the motor truck was all but lost sight of, and it was not until the year 1910 that the truck industry again began to show signs of life.

In 1911, the Mais truck was brought out with an internal gear drive designed by Mr. Albert F. Mais. In this axle the jackshaft was carried in front of the load carrying member, the latter being a round, nickel steel bar bent outward in the centre to give clearance for the differential gear box.

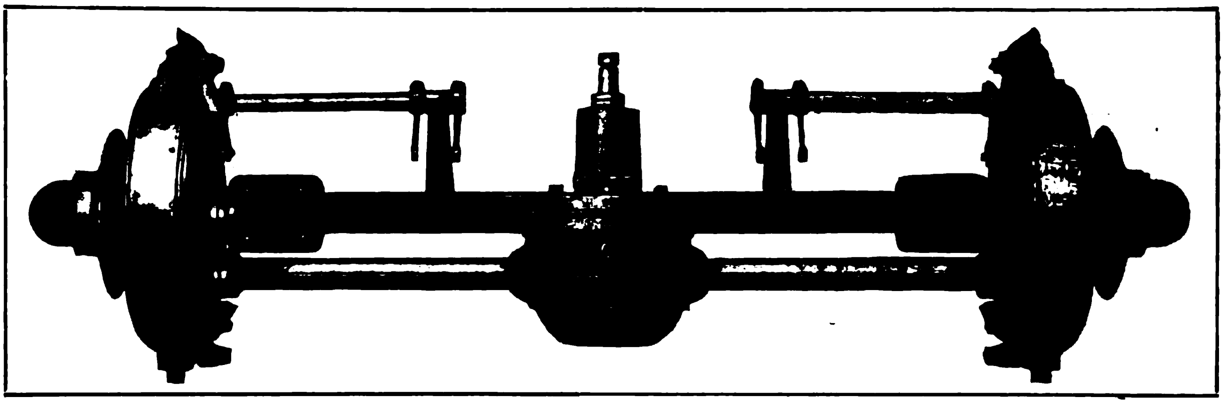

Fig. 4—Top View of the Torbensen Rear Axle Fully Assembled and Ready for Installation of Wheels and Springs.

The gear ratios were not so well arranged for best results as they might have been. There was too much reduction at the bevels and too little at the internal gears; consequently, the jackshaft speed was too low, necessitating larger and heavier construction than would otherwise have been the case.

Altogether this axle was a rather massive and heavy one, which, combined with a design not any too well adapted for economical production, made its manufacturing cost too high, and undoubtedly had something to do with the non-success of the company financially, for it "got on the rocks" after a couple of years' existence, and disappeared from view, although its trucks kept on running, and, to the best knowledge of the writer, the axles kept on giving and are still rendering most excellent service.

Nothing has been said in the above about another system of internal gear drive used to some extent in this country and abroad, chiefly in France, where it originated, to a much greater extent. This is the De-Dion Bouton drive as used on all the Fifth avenue 'buses in New York City continuously up to the time of the beginning of the European war, when further importation of these 'buses ceased.

The construction of these axles differs materially from American practise insofar as the jackshaft or driving member is not an integral part of the axle unit. As a matter of fact, the differential gear box is suspended from the frame and is free to move with it in a vertical plane. Flexible connections are, therefore, necessary between the differential and the internal gears, and these are furnished by short cardan joints.

Although the operation of these 'buses has been eminently successful from a commercial standpoint, the axles are not as quiet as they might be, and this is due to the fact that the necessity for using the cardan shafts makes it difficult to keep the driving pinions in true and perfect alignment.

Although these axles are built in France and, therefore, are not an American product, but distinctly different to American practise, men-

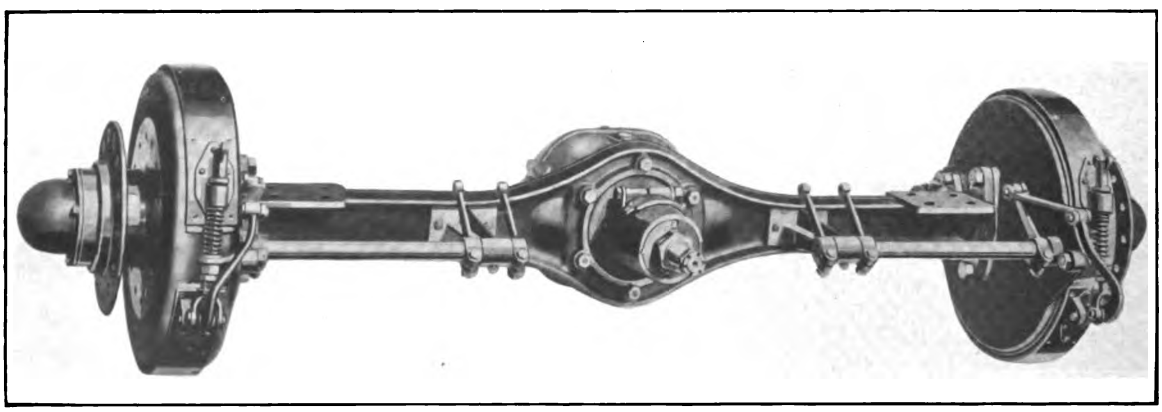

Fig. 5—Front View of the Fully Assembled Torbensen Rear Axle.

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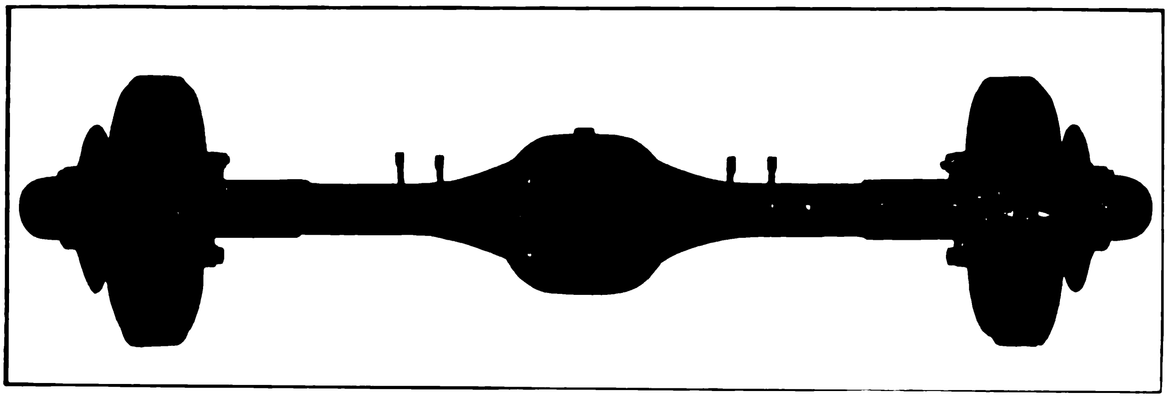

Fig. 6—Rear View of the Fully Assembled Torbensen Internal Drive Rear Axle.

tion is made of them in this article because they have been in use so prominently here for a number of years, and add their testimony to the successful application of the internal gear drive.

Coming back again to the purely American design and later practise, we find them in the axles made by the Lauth-Juergens Company, now the H. G. Burford Company; the Torbensen Gear and Axle Company, the Russel Axle Company and the Thomas B. Jeffery Company, and in use as standard equipment by such concerns as the Republic Motor Truck Company, the Thomas B. Jeffery Company, the International Harvester Corporation, the H. G. Burford Company, the Bessemer Motor Truck Company, the H. J. Koehler Company, the Denby Motor Truck Company and many smaller and less well known concerns.

The three companies first mentioned are among the largest producers of trucks in this country, and combined they produce more trucks than any other three concerns, excepting some of those working on war orders, and without a question of doubt, the internal gear drive axle is used today on three out of every five trucks built for the American trade.

The recognition of this form of final drive is not a thing that just happened. The average user of trucks in this country is discriminating and intensely practical. The principle of having a solid "dead" axle carry the load and a "live" axle transmit the power, appeals to him, and the results have justified his judgment.

The distinct American practise of making the live axle a component part of the axle unit can, therefore, now be considered as standard practise, and of the two designs, the one having the jackshaft back of the load-carrying member is by far the most popular.

The latter construction is, therefore, the one shown in this article. It represents the practical results of 14 years of development of the internal gear drive axle. It has grown from almost nothing at all into as perfect a piece of mechanism as American ingenuity, skill and the resources of ample and modern manufacturing facilities can make it.

Consider for a moment the I beam shown in Fig. 1. This is a drop forging, hammered out from a bar of nickel steel or carbon steel, as the case may be, struck up in huge steel dies, rendering every forging an exact copy of every other I beam forging made by the same dies. This forging is clean cut, symmetric and scientifically designed, of such shape that it gives the greatest possible strength with the smallest possible dead weight.

The design of I beam forging, furthermore, is such that it requires a minimum amount of machining. Here, then, we have the load carrying member, the foundation upon which the truck is built, fulfilling all requirements of a carrying axle in the highest degree possible, and in connection therewith the light, high speed, semi-floating, bevel geared drive shaft, the same as is used universally and successfully in driving a million or more automobiles all over the world, to transmit the power to the wheels.

Figures 2 and 3 show an end view of the axle with

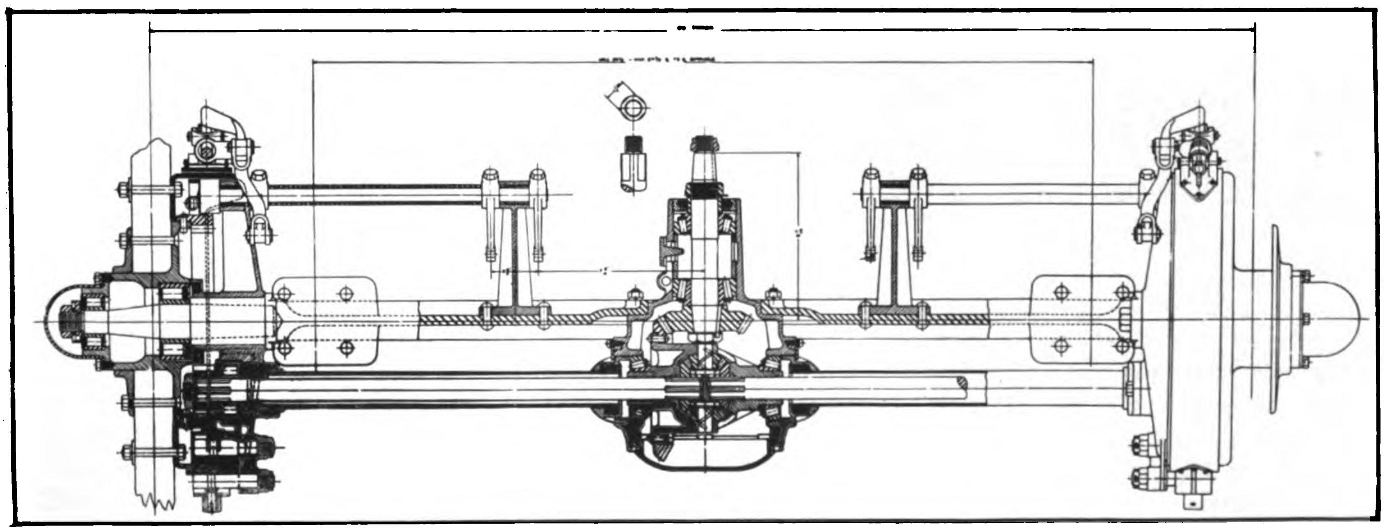

Fig. 7—Sectional View of the Torbensen Internal Drive Rear Axle, Showing the Detail of the Construction.

driving pinion in position, and the hub containing the internal gear respectively.

The pinion is case hardened, and the internal gear oil tempered and will, therefore, last a very long time before needing to be replaced. As a matter of fact, the internal drive gear is never expected to need replacement at all.

Figure 4 shows the centre of the axle rear view, with cover removed, and figures 5 and 6, top and front views respectively.

Figure 7 shows the sectional view and figure 8 a rear view of complete axle.

Figure 9 shows the brake drum and service brake.

CHARGE BRIBERY IN FENDER TESTS.

Charges that money was collected from members of the Fender Manufacturers' Association by Emmanuel Friedlander, president, and that approval of the product by the testing committee was guaranteed to every company that made the donation, have been made in Chicago by H. L. Eisenhauer, president of the Telescopic Fender Company. His company paid more than $300 for the purpose and he claims it was given a receipt for this money by Friedlander.

His fender has not yet been approved, however, and this brought about the exposure. The deputy superintendent of police in charge of the tests declares that the money was collected for the purpose of bribing the committee, but that the attempted bribery was unsuccessful. The product of the Standard Fender Company alone has so far been approved, but the chief of police has refrained from issuing a certificate to that effect to avoid giving one company a monopoly. The fenders tested are for use on trucks.

EXPORTS CONTINUE GREAT GROWTH.

Exports of motor cars and trucks not only continue, but are growing at a remarkable rate. The Department of Commerce Report for September shows not only tremendous increases for September as compared with the same month of a year ago, but large increase over August, 1915.

Exports of trucks for September totalled 2227, valued at $5,882,255, 4299 passenger cars valued at $3,215,459 and parts to the value of $1,613,419. This is a great gain when compared with 128 trucks valued at $294,288 in September of last year, 646 passenger cars valued at $597,904 and $34,618 worth of parts.

The New Departure Manufacturing Company is adding extensive new buildings to its plant at Bristol, Conn., to be used by its grinding and heat treating departments. The grinding rooms will be the largest in the world and 230 furnaces will be operated in the heat treating department. The plant at present is running 23 hours a day.

AN ORIGINAL TAXI SERVICE.

The Yellow Taxi Cab Company, which entered business in Chicago, Aug. 2, with 50 cabs, is doing nearly everything as it is not usually done in the public service operating, and its original methods are said to have been an instant success.

Instead of buying cabs, it bought standard parts and assembled its own cars. The parts are made by the best makers and the machines built probably cost less than they could if bought from car manufacturers who have to add overhead and sales expense to their prices.

The cabs are operated at the lowest rates ever offered in Chicago—25 per cent. under the low rates enforced by recent action of the Chicago city government. The cars are rented at what is claimed to be the lowest hour rate in the world—$2.50. For one passenger the rate is 30 cents for the first one-third mile and 10 cents for each additional one-third mile, with 10 cents charge for each additional passenger.

The drivers are all bonded and only married men are given employment. In addition to their regular pay they share in one-quarter of the profits of the concern, which are to be distributed annually. The purpose is to give them a personal interest in the business, to make them courteous and provide the best possible service.

No public stands are hired, as this is said to be impossible at the rates. Instead, the cabs are called by telephone. There are lamps in certain districts of the city which are lighted by the dispatcher when a call comes in. When a driver answers the call the lights are extinguished.

The cabs are handsome in appearance and will be kept especially well painted and clean. They are being turned out as rapidly as possible and it is intended eventually to operate 1000 of them in Chicago. The men who have for a long time operated the Walden S. Shaw limousine service, have organized and operate the company.

NEW GAS ELECTRIC TRUCK.

The National Brake and Electric Company of Milwaukee, Wis., is engaged in the development of a new heavy duty motor truck of the gas-electric type, which is said to be especially adapted for war service. The company is one of the Westinghouse group. The National company manufactures compressors, gasoline locomotives, air brakes and electrical appliances. The men employed in the plant have been increased in number from 700 to 1000 since July 1.

The Lowell Cutter Company of Lowell, Mich., which has been in business since 1885 as a manufacturer of cutter bodies, is about to begin the manufacture of trailers.

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ECONOMIC ADVANTAGES OF PHILADELPHIA THIN PLATE BATTERIES IN TRUCK SERVICE.

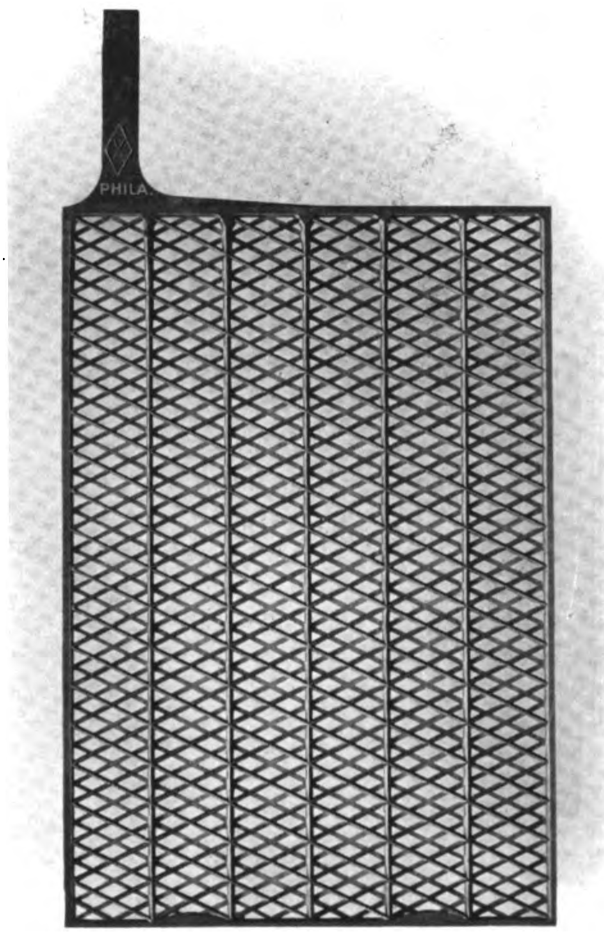
(By James M. Skinner, Engineer of the Philadelphia Storage Battery Company.)

THE Philadelphia thin plate battery has now completed its sixth year of successful operation in electric truck service. Put on the market in 1909, the type WT has been improved and perfected, year by year, being succeeded in 1912 by the lighter, higher capacity WTX, and reaching its highest development in 1915 in a still lighter, still higher capacity type, the WTXI. The WT quickly displaced the older, heavier type of plates which had been standard prior to 1909, the WTX displaced the WT, and the WTXI in turn is now engaged in displacing the WTX. What are the economic advantages of Philadelphia thin plates which enable each successive type to capture the truck field and displace its predecessor?

The first big advantage of Philadelphia thin plate batteries is that they are "oversize." The trend of the times is toward "oversize" equipment. We use tungsten lamps, not of the same candlepower as the carbon lamps of a few years ago, but of higher candlepower, electing to obtain more light rather than lower cost, we insist on oversize tires for automobiles and demand more speed than we are usually able to utilize—in all directions we demand a bigger margin than heretofore. Philadelphia thin plates meet this demand as applied to electric trucks. Users want more mileage than formerly. Philadelphia thin plates have increased the daily mileage of electric trucks from 50 to 100 per cent. Higher speed is insisted upon. Philadelphia batteries maintain higher car speed than was dreamt of a few years ago. An electric pleasure car equipped with a standard Philadelphia WTX battery made the trip from Philadelphia to Boston at an average speed greater than 20 miles per hour.

At first glance it might appear that the demand for "oversize" equipment is unwarranted, and that people are buying something that they cannot use. The electric truck of a decade back had neither the mileage nor the speed of the present day thin plate equipped car, yet it went about doing its work and apparently gave satisfaction. Of what use then is the increased mileage and speed of the present day car?

The answer is that greater mileage and higher speed have added immensely to the radius of operation and the flexibility and the reliability of the electric, and have decreased battery maintenance costs. They have brought a larger field of operation within the capability of the electric and have reduced the operating expense. If the daily mileage required is small, a thin plate battery need only be charged once every two or three days. If snow or bad roads cause excessively high power consumption, the "oversize" characteristic of the thin plate enables the car to cover its usual route without difficulty. If conditions change and longer distances must be travelled per day, the battery is ready and able to meet the demand. Even if the mileage required is 25 or 30 per cent. greater than can be supplied by the normal capacity of the battery, 25 or 30 per cent. additional capacity can be obtained from the battery by means of an hour's boost at noon or a few minutes' boost each time the car returns to the loading station. By simply varying the amount of



The Diamond Grid, Used in All Philadelphia Thin Plates.

charge given to the "oversize" thin plate battery the car automatically takes care of short routes and long, good weather and bad, dull seasons and rush times.

See what this means when reduced to concrete figures. The mileage capacity of a one or two-ton electric 10 years ago was 30-35 miles. The first Philadelphia thin plate, the WT, increased this to 45-50 miles. The WTXI will give 55-65 miles, and with the aid of a little boosting, 75-80 miles per day. In other words, the mileage capacity of the present day thin plate

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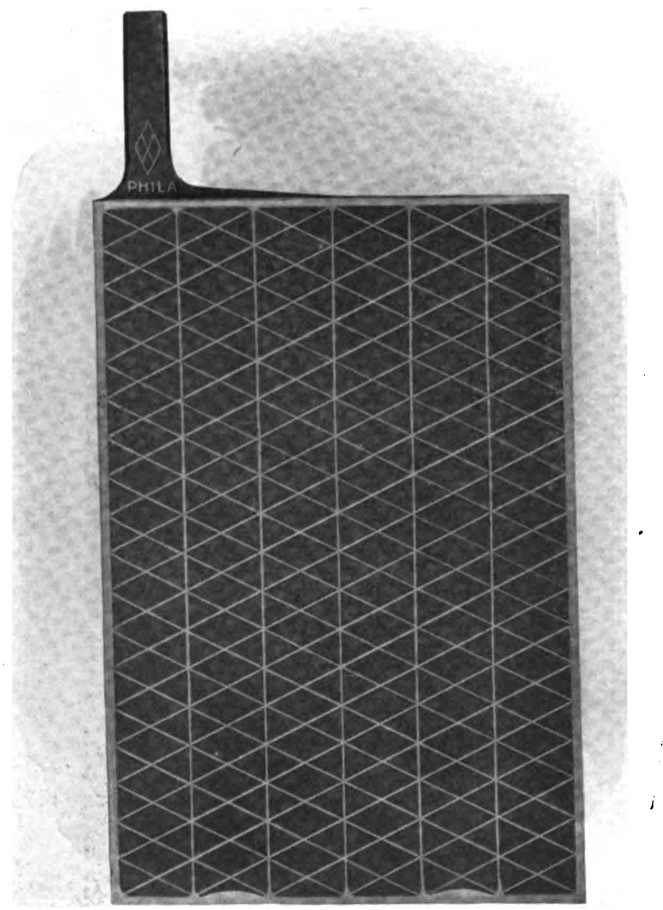
equipped electric is double that of the electric of 10 years ago. The present car is not merely a fair weather, limited mileage proposition. It adapts itself equally to good weather and bad. Snow has no terrors for it. It may be shifted on a moment's notice from a 20 to a 50 or 60-mile route. The big "oversize" thin plate battery makes it adaptable for every emergency of city delivery.

The second advantage of the Philadelphia thin plate battery is moderate price. The initial price is the lowest possible for a high quality battery and the renewal price is approximately only 65 per cent. of the original price. The low price reduces the investment and brings the cost of the car within the range of the small merchant. Low initial battery cost is also of importance to the user of a fleet of trucks. A saving of from $500 to $1500 per car on the price of the battery does not seem so much in itself, but when multiplied by the number of batteries used in a fleet of 20 trucks it amounts to the respectable sum of from $10,000 to $30,000. The low initial price of the Philadelphia thin plate batteries is of value to both the large and small user.



The Finished Plate, Showing the Truss Construction That Insures Great Rigidity.

The third advantage of Philadelphia thin plate batteries is low operating and maintenance cost. This is the product of many factors. A big factor is the "Diamond Grid." Philadelphia thin plates are all pasted upon the diamond grid. The diamond grid is built like a bridge truss with members so interlacing and having such mechanical strength that buckling is practically impossible. The interlacing of the members moreover provides another exclusive Philadelphia feature. The active material is actually locked between the members on the opposite sides of the plate and cannot jar loose and fall out.

Another factor is the Philadelphia long-life paste composition, developed especially for thin plates, in combination with the Philadelphia hard wood separator. It has been argued that it is useless to use exceptionally long-life plates in storage batteries, since exceptionally long-life could not be realized because of premature failure of the wood separators. This argument has force when applied to batteries containing ordinary soft wood separators. The life of the plates in such batteries is often limited by the shorter life of the soft wood separators. Philadelphia batteries, however, are all equipped with hard wood separators. These are cut from carefully selected stock, bought under rigid specifications and practically always outlast the plates. The Philadelphia hard wood long-life separators are an important feature in Philadelphia thin plate batteries because they permit the realization of maximum plate life.

Still another factor in low operating cost is the high rib, high quality rubber jars. The high ribs provide sufficient space underneath the plate to accommodate all of the sediment accumulated during the life of the battery and no expensive, time-consuming cleanings are required. The high quality means more new rubber in the jars, and adds to their cost, but it practically eliminates jar breakage. All Philadelphia thin plate batteries are assembled in high rib, thick walled, high quality jars.

The high efficiency of Philadelphia thin plate batteries is another factor which reduces the operating cost. The Philadelphia thin plate battery requires less current per car mile than any other battery on the market. The alkali battery, as is shown by records of actual operation, requires at least 40 per cent. more charging current. This item alone represents a saving in using the Philadelphia thin plate of from $50 to $300 per year, depending on the size of the car, the miles run and the cost per unit of charging current.

Another factor in the low operating cost of Philadelphia thin plate batteries is the small amount of regular daily attention they require. Regular charging, systematized to avoid gassing and heating, and periodic flushing with pure water constitute the sum total of the attention required. In fact, experience has shown that the less attention given, beyond ordinary cleanliness, systematic charging and regular flushing, the better the results obtained. When it is considered that thousands of Philadelphia thin plate batteries in pleasure vehicle service are giving complete satisfaction in the hands of non-technical men and women owners who merely adhere strictly to a few simple rules, it will be seen that the daily attention required

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cannot be very exacting. There are on the market today many forms of charging apparatus, low in cost, efficient and absolutely reliable, which automatically give the battery a proper charge with no attention or adjustment whatever on the part of the operator. Such apparatus to date has found its largest application in the electric pleasure vehicle field, but there is no good reason why it should not be just as widely applied in commercial battery charging. Philadelphia engineers are always ready to co-operate with car owners in the selection of operating apparatus suitable to their requirements.

The final factor tending toward long life and therefore lower maintenance cost from Philadelphia thin plate batteries, is their "oversize" characteristic. Thick plate and other low capacity batteries in electric trucks are often greatly overworked. They are overdischarged and overcharged. In order to give maximum life a battery should not be overdischarged nor overcharged. Perhaps an explanation of the reasons for this fact will not be out of place at this point. The two factors tending to wear out a battery are gassing and the chemical combination of the active material with the acid of the electrolyte. Gassing is a product of charging, the combination of the active material with the electrolyte is the essence of discharging. Gassing represents waste. As long as the battery is capable of absorbing all the charging current no gas can be generated. It is only toward the end of a charge when the amount of discharged material is small that there is much danger of gassing. At the beginning of charge the large amount of discharged active material in the plates enables the battery to take a very high rate of current without gassing. As the charge progresses the amount of discharged material decreases, and if the current rate is not reduced, either manually or by automatic apparatus, there may be more than can be absorbed, and the excess will be dissipated in producing gas. The gas bubbling out from the pores of the plates exerts a washing action on the active material and causes some of it to loosen from the plate and fall to the bottom of the cell. The disintegration is slow, but it is inevitable if gassing is permitted, and the more gassing, the shorter the life of the battery. Now just here is where the "oversize" characteristic of the thin plate comes in. The nearer to a fully charged condition that a battery approaches the heavier the gassing. Fully one-half the wear due to gassing occurs during the last five or 10 per cent. of the charge. Therefore, it is desirable to reduce to a minimum the amount of charging given a nearly fully charged battery. Since the capacity of a thin plate battery is greater than is usually needed, except for emergency, it is possible and desirable not to charge the battery fully, except once every week or two, but to bring it up ordinarily to say only 90 or 95 per cent. full charge, thus eliminating on all but a few charges the last five or 10 per cent. of the charge which causes the greatest wear on the plates.

Just as wear due to charging becomes more pronounced the nearer a battery approaches a fully charged condition, so the wear due to discharging becomes more pronounced the nearer a battery reaches a fully discharged condition. Discharging tends to fill up the pores of a plate by the formation in the plate of lead sulphate. This is a perfectly normal condition. Lead sulphate is simply discharged active material. Unless lead sulphate forms there can be no discharge. Now lead sulphate occupies more space than did the charged active material, and it is a characteristic of a well designed plate that sufficient porosity has been

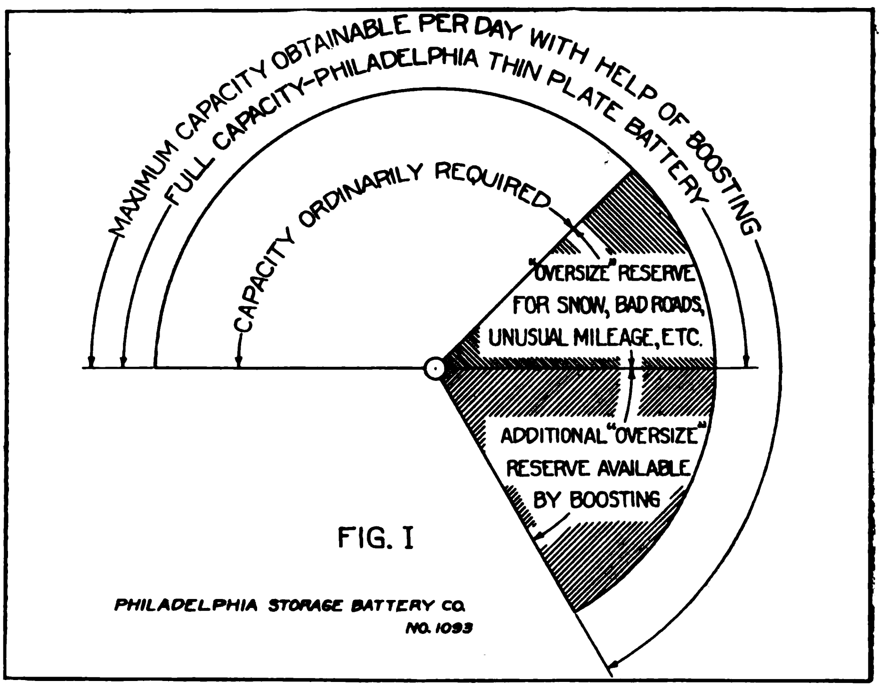

Diagram Showing the Capacity Range of Philadelphia Thin Plate Batteries.

provided within the plate to accommodate, without excessive strain, all the lead sulphate which forms on an ordinary discharge. It is inevitable, however, that discharging should cause some dislodgment of the active material. The more completely discharged a plate becomes the more the pores become filled with sulphate, the less space there is for the formation of more sulphate and the more likely it is that surface particles will be pushed off by the sulphate accumulating behind them and unable to find pore space in which to grow. It is just here that too hard plates fail. They have very little porosity. The amount of sulphate necessary to fill the pores is small, less than is likely to be produced on even a moderate discharge, consequently the strain imposed upon the plate by discharging is very great and either material will be dislodged or the plate will tend to buckle under the strain. Very hard, dense plates may be well adapted to withstand wear due to charging, but they are ill

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adapted to withstand much discharging.

Philadelphia thin plates are built to withstand discharging wear as well as charging wear. Porosity is not sacrificed to obtain maximum hardness. There are enough pores to accommodate all the sulphate which is formed during discharge, so that even under conditions of heavy discharge they wear slowly. But even this slow wear is greatly diminished by their "oversize" characteristic. To obtain all the mileage desired it is rarely necessary to discharge them to more than three-fourths of their full capacity. Experiments have shown that the life of the battery in days is greatly increased if it is seldom discharged to its maximum capacity. Maximum life in days and miles is obtained when a battery is regularly recharged after about 80 per cent. of its capacity has been used. Charging before 80 per cent. has been used increases the wear due to charging unless exceptional care is taken to eliminate gassing. Using more than 80 per cent. of the capacity before recharging emphasizes the wear due to discharging. The "oversize" characteristic of the Philadelphia thin plate makes it possible to operate a Philadelphia thin plate battery on 90-95 per cent. charges and 80 per cent. discharges and thus obtain maximum life.

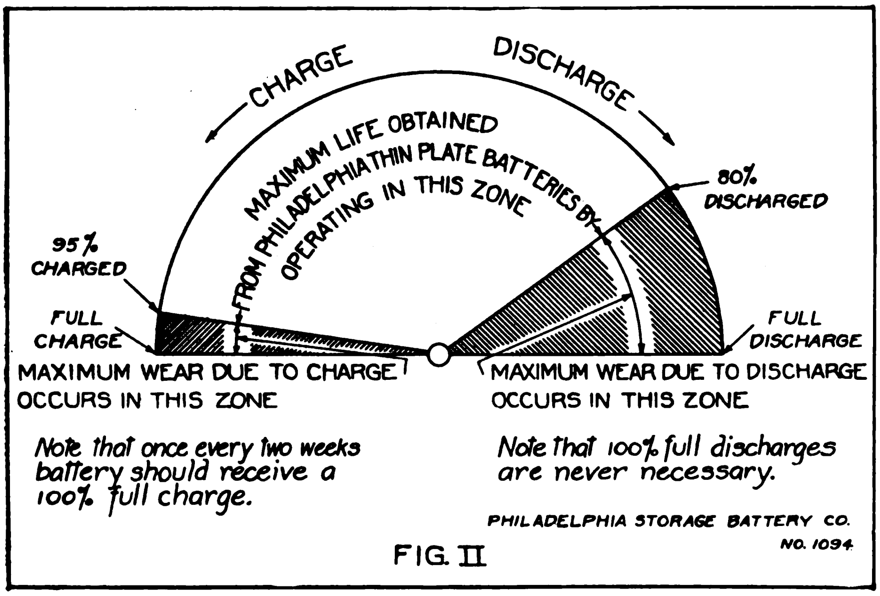

FIG. II

Diagram Illustrating How Oversize Capacity Insures Against Wear in Service.

In carrying out this procedure it must not be forgotten that a full charge followed by an overcharge at a very low current rate is desirable once every week or two. The slight daily undercharging leaves in the plates a small amount of discharged material, which tends in time to harden to an undesirable extent. The weekly or bi-weekly overcharges convert this discharged material to charged material at regular intervals, thus periodically bringing the plates up to their maximum capacity and keeping the battery in the best operating condition. Complete information as to the details of operation will be found in the instruction book published by the Philadelphia Storage Battery Company.

The foregoing facts have an important bearing on the subject of boosting. In hard service, where great mileage is required, it is always better to boost than to discharge a battery to its fullest extent. The reason for this is not hard to perceive. Too full discharges cause excessive wear. Charging also causes wear, but there should be very little wear on a boost which follows the very simple instructions given in the booklet on "Boosting," issued by the Philadelphia Storage Battery Company. The current rates employed are high, it is true, but they come at a time when the battery is sufficiently discharged to stand high charging rates, and the boost is not continued up to the point of full charge so that there should be very little, if any, gassing and, therefore, very little wear. Boosting causes a battery to work just where it works with least wear, namely, in between the extremes of full charge and full discharge. In heavy service boosting actually tends to increase the life of the battery and may be employed without hesitation.

To retard the wear on the plate, Philadelphia thin plate batteries are provided with finely perforated rubber sheets, which are placed against the positive plates. These sheets serve their purpose very well and the actual falling off from the plates of loosened material is greatly retarded. Attempts have been made at various times to extend this protection by further enclosing the positive plates, as by envelopes or otherwise, but these have proven unsatisfactory in that they do not greatly increase the life of the plates beyond that obtainable by the finely perforated sheets, and they do largely increase the cost, weight and space necessary for a given capacity, and entirely eliminate the important "oversize" characteristic.

Summing up, the economic advantages of Philadelphia thin plate batteries are three:

1. They are "oversize" batteries.
2. Their price is moderate.
3. The cost of operation is low.

Due to their "oversize" they are prepared for any service, easy or hard. They meet equally well the moderate mileage of dull seasons and the greater mileage of rush times. They are able to cope with the increased demands imposed upon them by snow and bad roads without reduction of the usual route. They possess to the highest degree the quality of adapting themselves to the demands of the service.

The moderate price of Philadelphia thin plate batteries renders it unnecessary to tie up excessive amounts of capital in the transportation department and the low operating cost reduces to a minimum the monthly expenses. The Philadelphia thin plate battery embodies to the highest degree the ability to meet the requirements of any service at the lowest possible cost

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THE COMBINED RADIAL AND THRUST BEARING.

By W. S. BENNETT, Sales Manager, the Bower Roller Bearing Company.

IN AUTOMOBILES today construction is being based more and more on the demand for economical operation both as to cost per mile and cost per year. This requires efficiency of design to produce a light weight car and, at the same time, the use of material which gives maximum life.

Bodies are being built with the idea of presenting the least possible resistance to the air at various speeds. Motors are being made which, with the minimum practical weight, develop highest efficiency and operate with absolute reliability. Springs and spring suspensions have been studied with a view to eliminating shocks to passengers and to the driving mechanism. Careful thought has been given to the development and manufacture of gears which will be strong and light and which will insure, throughout the life of the car, the noiseless and efficient transmission of power. Also frames, axles, and, in fact, all parts entering into the construction of the automobile, have been brought to a minimum in weight through the use of high-grade materials. All of these improvements have been brought about through the co-operation of engineers, designers and metallurgists with their increased knowledge of metals and metal working.

Bearings Highly Perfected.

In like manner the bearings used in the automobile have been brought to a state of perfection once thought impossible. The cup and cone ball bearings, the first of the so-called, anti-friction bearings, gained considerable popularity through their use in bicycles. From this beginning we have the bearings of today, which are the result of the growing demand for a bearing of greater and greater capacity.

This demand for high capacity has been most satisfactorily met by the roller bearing. Throughout the changes in automobile construction, the roller bearing has played a very important part, but the high-grade materials now used, permitting the reduction in size of spindles and housings, have made absolutely necessary the use of the high capacity roller bearing.

Three Types of Roller Bearings.

Of the roller bearings at present manufactured, there are at present three different types; i. e., the flanged head, solid, straight roller bearing, the plain straight roller bearing and the taper roller. Of these three types, only the first and the last mentioned bearings take thrust as well as radial loads.

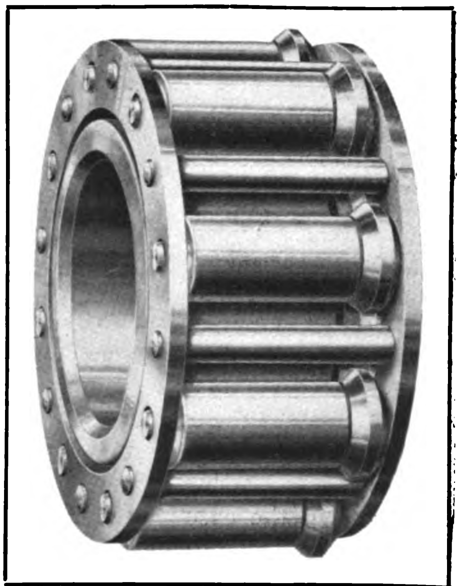
It is the purpose of this article to point out a few of the advantages of the flanged head, solid, straight roller bearing, known as the Bower roller bearing, and it is possible that a few of the points considered by the designer (Mr. E. F. Bower) will be of interest.

Development of Bower Bearing.

The present type of Bower bearing has been developed from a bearing used in the wheels of horse drawn vehicles, both heavy and light. The original bearing was adapted to the metal boxes used in the old type wooden hub, known as the Sarven hub, and was furnished complete with spindle, bearings and boxes. The change in manufacture of wheels and the adaptation of the bearings to uses other than wheel work, has modified the bearing, both in design and manufacture, although the original idea of the straight roller, operating between parallel raceways grooved to accommodate the flanged head of the roller, is still held to.

Bearings to Carry Two Loads.

The ordinary installation of an anti-friction bearing demands not only a bearing that will take the load at right angles to the shaft or spindle, but also one that will take care of the load in the same direction as the shaft, such as the load caused by the side sway or thrust of a wheel passing over uneven roads. The body of the roller of the Bower bearing answers satisfactorily the first demand, while the flanged head, running in grooves in both inner and outer races, allows the bearing to take the lateral or side thrust. It has been found from careful experiment that an accurately ground 45-degree angle on the flanges of the head and on the surfaces of the race ways in contact with the flanges on the heads, offers much less resistance to turning and gives greater capacity than any other form of flange, and for this reason the surfaces, resisting thrust loads, in the Bower bearings, are all ground at 45 degrees.



Bower Roller Bearing with the Outer Race Removed to Show the Rolls as They Are Assembled in the Cage.

The nearly perfect conditions, under which this bearing operates, can be seen from the accompanying sketch, which illustrates the fact that all loads have reactions in the bearing parallel and opposite to the direction in which the loads are applied.

Small Resistance and Great Endurance.

The advantages of this type of bearing are many, as can be seen from a careful examination of the bearing. The straight roller, operating between parallel

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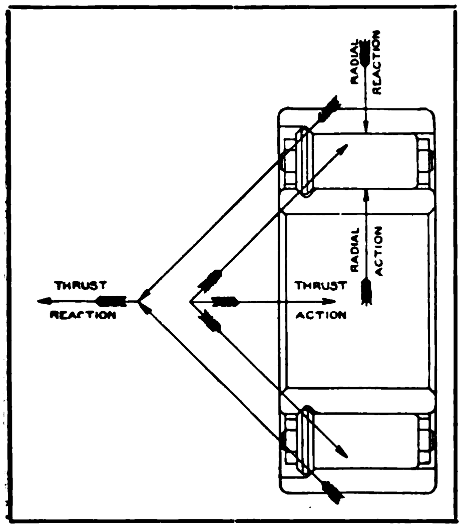


Diagram Showing the Resistance of the Bower Roller Bearing to Radial and Thrust Pressures.

race ways, offers a minimum of resistance to turning. This holds true over a great range of loads since the various parts of the bearing hold their same relative positions at all times. Owing to the fact that the loads are carried over so great an area, there is practically no distortion and high efficiency is assured, as well as durability.

While it is true that any material may be subjected to a certain number of changes in form, and there is a limit beyond which it is unsafe to go, but the margin of safety is wide in the Bower bearings because they are so little changed by the loads. This also makes for durability.

Full Resistance of End Thrust.

Besides this, the work of the bearing is divided so that a separate surface carries each load; the radial being carried by the body of the rollers and the thrust load being equally distributed on the heads of the rollers. This assures extra wearing surfaces and prolongs the life of the bearing.

Silence is another feature that has been obtained in the Bower bearing as a result of the long lines in contact. In the case of the radial loads, the line of contact is the entire length of the one or more rollers that are in action at any one time. In the case of the thrust loads, the line of contact is the length of the flange of each roller head multiplied by the total number of rollers.

Finally, the fact that all necessary adjustments are made by experts, where accurate gauges and means of measuring are at hand, assures satisfactory operation, this bearing requiring no attention aside from provision for lubrication.

In general the flanged head, solid, straight roller bearing is adapted for any work where both radial and thrust capacity is required. In wheels, transmission, etc., it lends to economical manufacture and operation of any automobile, because of its easy installation and because it requires no adjustment and at the same time gives unquestionable efficiency and durability.

The manner in which this bearing has been received and the long list of users, both among automobile and parts manufacturers, are the best proof of the statements made in its favor.

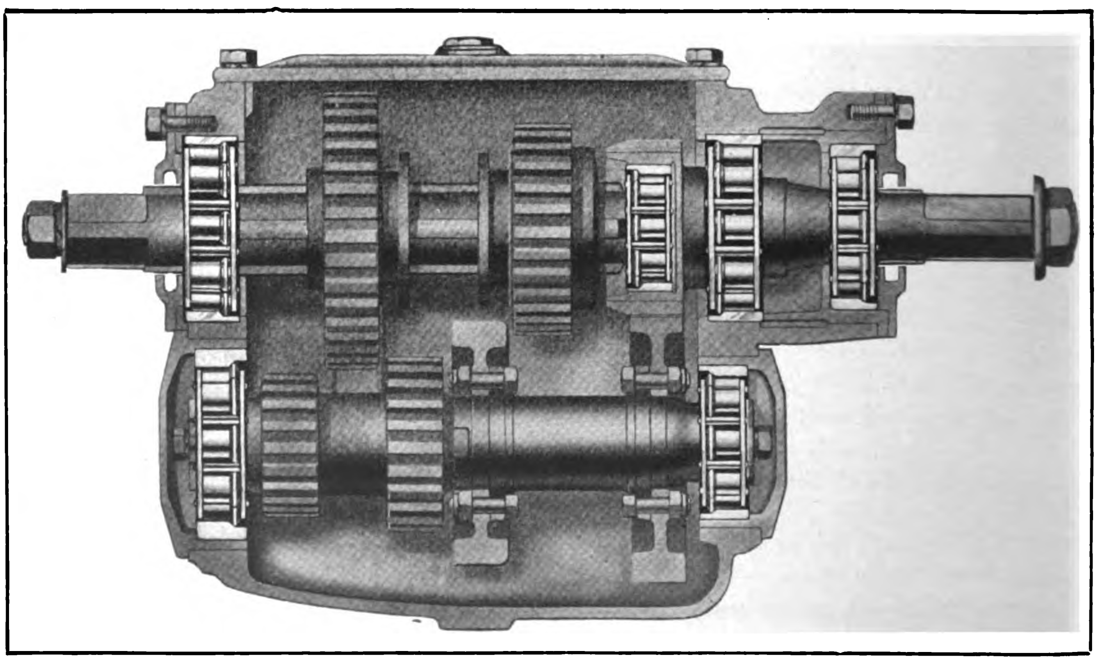
GAS SHORTAGE THREATENS TAXICABS.

The shortage of gasoline in Paris is so severe that the taxi cab service may have to be discontinued. The oil companies say the shortage is due to the fact that they cannot get the tank boats, which carry the supplies, up the Seine to Paris. The Russian and Roumanian supply, which is usually 20 per cent. of the whole, has been cut off, but gasoline can be had from America. The military has all the gasoline it needs and the civilians are asking whether they cannot be allowed some of it without hampering operations.

KELLY-SPRINGFIELD TO REDUCE STOCK.

It was proposed at a recent meeting of the Kelly-Springfield Tire Company's board of directors in New York City to reduce the par value of the common stock shares of the company from $100 to $25.. A special meeting of the stockholders will be held Nov. 30 to act on the resolution. The par value of the six per cent. cumulative preferred and the seven per cent. second preferred will not be altered.

Edward F. Moloney has joined the forces of the New York branch of the Gibney Tire Company as manager. He was formerly manager of the solid tire division of the Firestone New York branch.



Power Transmission Gearset with the Shafts Mounted on Bower Roller Bearings to Resist Radial and Thrust Loads.

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THE EFFICIENCY AND ECONOMY OF THE MOTOR TRACTOR IN HIGHWAY HAULAGE.

By R. W. SMILEY, Advertising Manager, Knox Motors Associates.

THE last 15 years have witnessed a rapid growth in the size of transportation units. Locomotives, freight and passenger cars, as well as trolleys, have all greatly increased in size and capacity. Freight cars now carry at least twice what they did 15 years ago and locomotives can probably haul three times as much as formerly.

Commercial vehicles may also be included in the list of transportation units the size and strength of which have greatly increased.

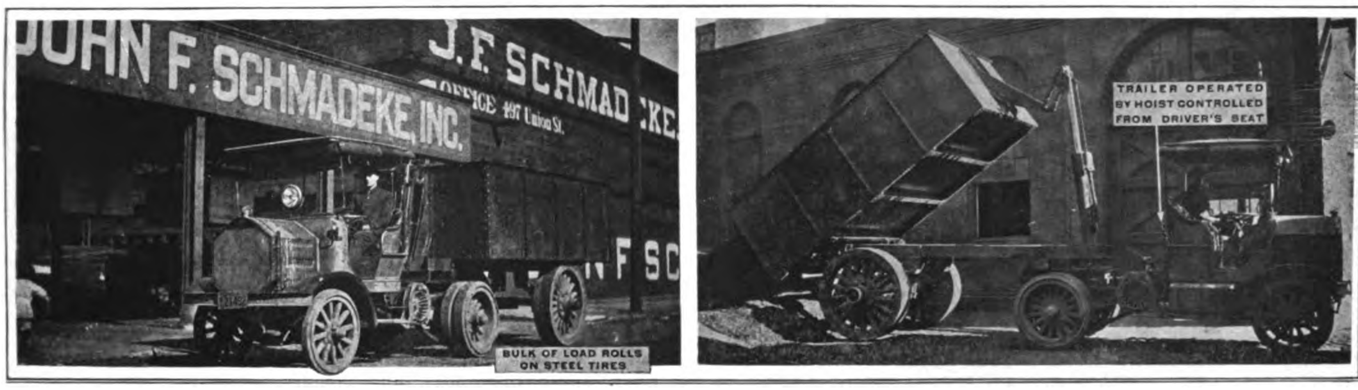
Increasing the tonnage which can be moved at one load naturally reduces the ton-mile cost which must be charged against the commodity handled provided this increased tonnage can be moved without disproportionately increasing the investment and operating cost of the larger hauling equipment.

As applied to the conventional type of motor driven vehicle for highway haulage—the motor truck—certain advantages, as well as certain limitations, are at once apparent. The first advantage is simplicity; the motor truck is a single unit, which both carries the load and propels, or pushes it through a rear wheel drive. It is equally apparent, however, that there is a limit to the tonnage which can conveniently and economically be carried in this way. The motor is limited to what it can push through a rear wheel drive, the body of the truck itself is limited as to cubical capacity, and there is also a limit which, speaking relatively, is soon reached as to the tonnage which can economically be carried on rubber tires.

Obstacles to Haulage Capacity Overcome.

Up to a comparatively few years ago these limitations of the motor truck seemed to offer definite obstacles to the plan of reducing the ton-mile cost of highway haulage by increasing tonnage moved at one time by the application of the gasoline engine. During the last few years, however, there has developed, largely as a result of the unceasing and specialized efforts of one company, a type of motor vehicle which applies to the highway haulage of heavy tonnage the same principles that have made possible the hauling of tremendous loads over steel rails—namely, a gasoline tractor capable of moving loads of from five tons to 40 tons over the highway.

In perfecting the tractor and trailer method, several problems had to be worked out. For one thing, it was necessary to devise a plan so that the driving wheels of the pulling vehicle, or tractor, would have sufficient traction to insure against slipping when hauling heavy loads. Again, it was necessary to arrange so that the trailing vehicle, or carrier, could be backed at will to any given position. Provision had also to be made for taking up the starting and stopping strains which accompanied the moving of increased tonnage.



A Knox Tractor and a 10-Ton Semi-Trailer Body in the Service of the John F. Schmadeke Coal Company, Brooklyn, N. Y.

Sufficient Traction with Partial Load.

A study of the tractor problem developed the fact that sufficient traction could be secured by placing from 25 per cent. to 40 per cent. of the paying load over the driving wheels of the tractor. That is to say, the front wheels and axle of the trailer were removed and the front end of the trailer was attached, by an ordinary king bolt pivot, to the rear of the tractor. In this form the carrying vehicle became a "semi-trailer," and tractor and trailer together became a six-wheeled unit. This combination also solved the second problem of being able to back the trailer into any desired position, the operation then being the same as that of backing a wagon with a team of horses.

The important problem of providing for the absorption of starting and stopping shocks was worked out in an ingenious way by the Knox engineers by entirely isolating the rear axle from the tractor chassis itself (a patented Knox feature) and mounting over this rear axle an independent set of heavy semi-elliptic springs to support the weight of the forward end of

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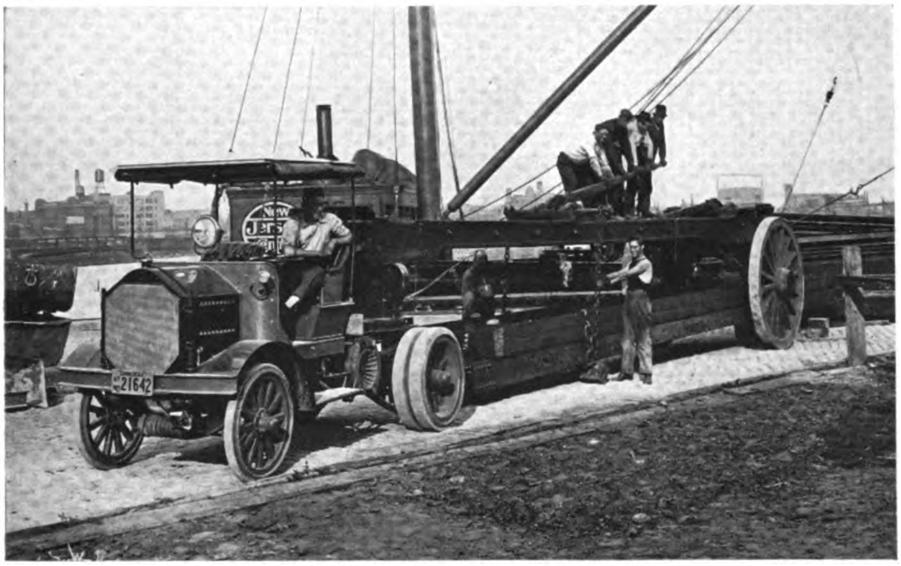


A Knox Tractor and a Type of Semi-Trailer Used by the Goodman Construction Company of New York City to Haul Heavy Steel Girders.

the trailer. In this way the resilient cantilever springs supporting the power plant, chassis and transmission, were absolutely freed from the burden of supporting any part of the paying load and were also enabled to cushion most effectively the shocks of starting and stopping heavy loads.

Tractor Primarily a Pulling Vehicle.

The tractor, then, is primarily a **pulling** vehicle. It has been variously called "a land tugboat," "a gasoline horse," "a highway locomotive," etc., because of the way in which its power is applied. It has overcome all the obstacles which formerly limited, and which still limit, the tonnage that can economically be carried in motor trucks.

First: The tractor operates in accordance with the universal conclusion of transportation engineers the world over—that loads which are too heavy to be **carried** economically, can be **hauled** efficiently and profitably. The tractor hauls its loads. With a single or "semi" trailer it constitutes a six-wheeled unit with the energy of the motor exerted as a pulling force. In reality, since the rear or power wheels of the tractor become the front wheels of the semi-trailer, it supplies the paying load with a front wheel drive. Additional four-wheel trailers may be added, if desired, so as to form a train, making it possible in this way to haul as much as 40 tons at a time. Thus by serving as a pulling, instead of a carrying vehicle, the Knox tractor furnishes hauling power sufficient for the most severe demands of heavy haulage.

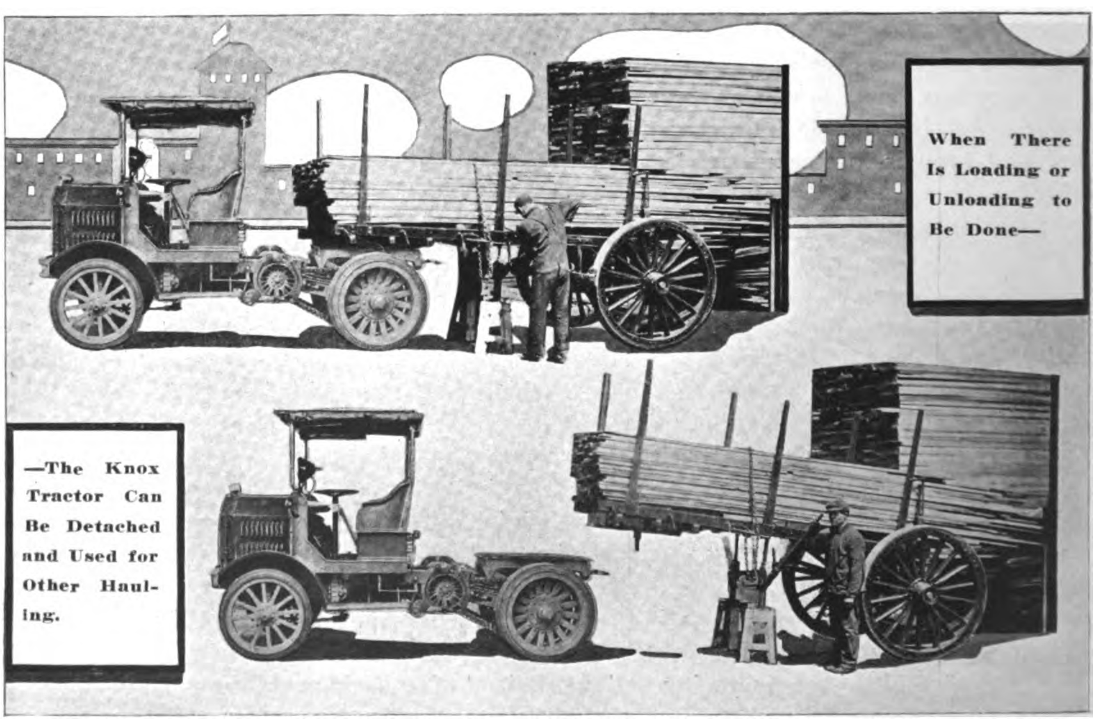
Load Carried on Inexpensive Tires.

Second. The rubber tire limitation of motor trucks disappears with the introduction of the tractor and trailer plan, which allows from 60 per cent. to 75 per cent. of the paying load to roll on the steel tires of a semi-trailer. Moreover, where four-wheel trailers are used, the total load rolls on steel tires. The economy of highway haulage most or all of which can be done on durable, inexpensive steel tires, as compared with short-lived, expensive rubber tires, is, of course, too obvious to require comment.

Third. A motor truck, being a carrying vehicle, is designed for a few special purposes and is unsuited to others. Therefore, in order to show returns on its investment cost it must be used constantly in that particular form of service. The tractor, being a detachable, interchangeable power plant, can be transferred from one form of service to another, merely by changing the trailer equipment. It is a highly economical vehicle, therefore, because its possible field of usefulness as a power plant is almost unlimited.

Tractor Can Be Operated Constantly.

Fourth. Unlike the motor truck, the tractor is not obliged to remain idle during waits for loading or unloading. It is only the trailer—the inexpensive part of the outfit—which is obliged to take this "time out." One tractor can keep several trailers and several loading crews busy, hauling one or more trailers, while



When There Is Loading or Unloading to Be Done—

—The Knox Tractor Can Be Detached and Used for Other Hauling.

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The Knox Tractor Can Be Quickly Detached from Trailers for Loading or Unloading and Set at Other Work.

others are at the terminals being loaded or unloaded. Thus it adds another item to the economies of heavy highway haulage by eliminating the costly element of "idle time."

Fifth. A great variety of bodies can be used with each trailer—low-hung wagons for hauling stone, stones, safes, etc.; bottom dumping; rear dumping; long or short trailers; passenger 'buses; structural steel and lumber vehicles, the majority of which are prohibited for use on a truck.

Sixth. A tractor with the proper hitch has immense power to move objects on rollers or drag them on the ground.

Efficiency in Special Works.

In the hauling of loose material—crushed rock, gravel, coal, etc., the tractor not only hauls loads of 10 tons in a rear dumping trailer, but by means of a hydraulic hoist operated from the driver's seat by the tractor motor, raises this heavy load to its full height in 50 seconds. Due to the broad, 10-inch tires on the trailer, the 10-ton load does not cut into the road surface, but acts rather as a road builder.

Structural steel, lumber and similar commodities requiring long trailers are hauled by the tractor with the same ease as rear or bottom dump trailers. For example, a Knox tractor in the service of the Goodman Contracting Company of New York Ctiy averages 34 miles a day, making 13 trips and hauling from seven to nine tons on each trip.

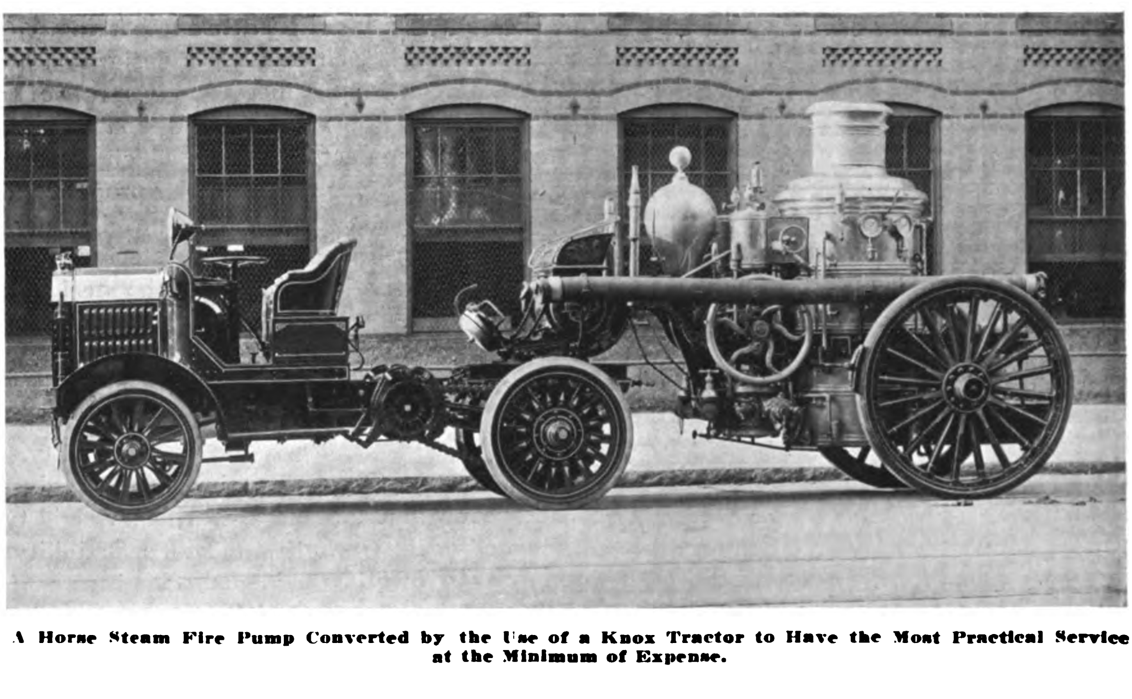
By using one semi-trailer and four four-wheeled trailers, Peters & Baird of Wadsworth, O., haul over 18 tons of crushed rock per trip, with a Knox tractor. This hauling is being done over two miles of paved roads and one mile of dirt road.

The tractor also makes an ideal power plant for the hauling of all types of fire apparatus. Several important economies are made possible in this field of hauling, one of the most obvious being that the horse drawn equipment need not be discarded, but may be retained and "tractorized."

In short, the tractor and trailer principle is destined to establish itself firmly and permanently in the field of heavy hauling for the simple reason that it gives the largest hauling capacity for the smallest original investment and at the minimum upkeep cost.

ELECTRIC GARAGE SERVICE.

Electric garages that have usually been conducted with a flat rate policy are beginning to adopt a system similar to that generally the vogue for gasoline machines, by which the owner pays for what he gets. With this system a definite charge, $8 in some instances, is made for delivering or fetching the car from 40 to 60 times each month. A deduction of 20 cents is made for each time less than 40 and an additional charge for each time in excess of 60. The charge for current is specified also and is based on the price for charging current made by the central station in the community. A charge of about $20 per month is made for general care of the car, cleaning, polishing, etc. A charge for dead storage is made if the car is laid up for more than 10 consecutive days of any month. Drivers are furnished for 50 cents an hour if desired, the owner taking all responsibility for what may happen to the car.



A Horse Steam Fire Pump Converted by the Use of a Knox Tractor to Have the Most Practical Service at the Minimum of Expense.

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HIGH DUTY HYATTS FOR HIGH DUTY HAULING.

Contributed by the Hyatt Roller Bearing Company.

FOR the work it does and the service it gives, there's nothing on wheels the equal of the motor truck. It carries heavy loads. It works long hours. It sees constant service. It is seldom given much care or attention. It sustains the heavy shocks and jars which solid tires will not cushion. Often it is overloaded, overworked, neglected and abused.

No matter what treatment it receives, the owner expects his truck to work and to keep on working. He has plenty of time to use it, but little time to repair it. He buys a truck for utility—not for repair-bill-ity.

The truck is expected to run a certain number of hours a day. It's safe to say that nine times out of 10 the time the truck works is exactly the time the driver works. When it stops—he stops. He hasn't the time to adjust a nut here or pour a little oil there. He is expected to spend his time in hauling goods, and not in nursing the conveyance. Time is too valuable to be lost in constantly tinkering with the machine. The truck that requires it is a nuisance.


The Driver Can Keep His Truck Moving with a Heavy Load and Eat if Necessary, but Horses Must of Necessity Stand While Feeding.

There are very few trucks of that kind. Manufacturers are not ambitious to be builders of a nuisance. They want to make trucks—trucks that **are** trucks—trucks which will meet all conditions.

Many difficulties have been encountered in building such a vehicle. Little insignificant parts which seemed of no consequence, turned out to be of a great deal of consequence because of the trouble they made. Such a part was the bearing.

The bearings used in automobiles, particularly in motor trucks, would often break down under the shocks and strains to which they were subjected. Wear was excessive. They were everlastingly needing oiling and adjusting. In short, they were a constant source of trouble and annoyance.

A strong demand was felt for a bearing which was not always in need of attention. As a result of deep study and exhaustive experiment, that demand was finally answered in the Hyatt roller bearing. Of this particular make of bearing the high duty type was found to be most satisfactory.

Construction of the High Duty Type.

The high duty bearing consists of an inner and outer race, cage and rollers.

Spirally wound bands of special analysis steel are cut into rollers of the required length, then subjected to a scientifically correct heat treatment, after which they are ground to absolute accuracy. The finished product is a hollow, spiral roll of chrome vanadium steel—the bearing roller. These rollers, which surround the shaft or axle, are aligned by being mounted in the rigidly built cage.

On the outside of the rollers is fitted a steel race. Another fits inside the series of rollers, in the centre of the cage. Both these races are made of special analysis steel, carbonized, heat treated and ground to extreme accuracy.

Strength of the Hollow Roller.

The Hyatt flexible roller will not crush under the heaviest load it is designed to carry. If there is no fault in designing of the truck, and the bearing is properly built into it, overloads may be carried and unnecessary strains endured with a great deal more danger to other parts of the truck than to the bearing.

Each bearing is designed to carry up to a certain maximum load at a given rate of speed. To greatly exceed that capacity, of course, endangers the continued satisfactory results which the bearing may be depended upon to give under proper conditions.

Its strength does not depend on solidity, but rather on the quality of the steel from which it is formed. In the winding process the steel fibres form an arch, and add enormously to the strength of the roller. The fine quality of the steel guarantees a resistance to loads and shocks much greater than it will ever be called upon to stand.

Flexibility.

The hollow in the roller gives it a wonderful advantage over the ordinary rigid type. It loses none of its strength and gains flexibility. Instead of rigidly meeting sudden shocks, it so conforms to the strain as to present a full contact along its entire length.

The flexible rollers adjust themselves to irregular-

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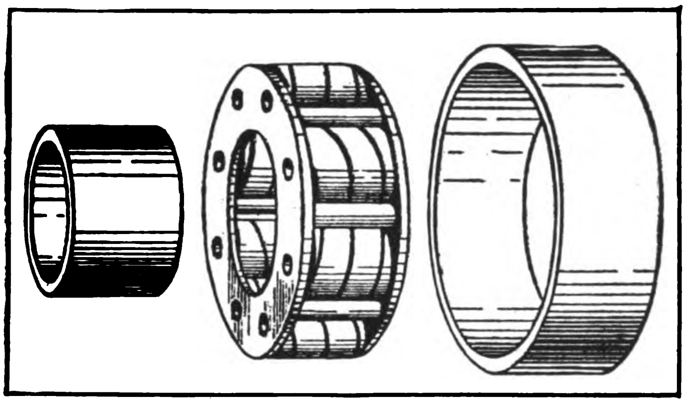


The Elements of a Hyatt Roller Bearing, the Two Races and the Cage Carrying the Rolls.

ities. They absorb vibration. Bumps and shocks are not directly transmitted to the surrounding parts. There is less train on those parts. Wear is not excessive. Permanent loss of alignment or actual breakage never results because of a sudden shock having been conducted through the roller.

Self-Lubricating.

The oil carrying capacity of Hyatt bearings is greatly increased by this hollow in the roller. The hollow center serves as a reservoir for the lubricant, making it unnecessary to add oil nearly so often. The driver is spared the inconvenience of having to squirt oil into the most inaccessible places every time he drives the car.

In the making of Hyatt rollers, strips of steel are wound so that a spiral slot runs the entire length. In the assembly of the bearing, these slots are made to alternate from right to left. When in motion they fill with lubricant and distribute it constantly over the surface of the roller. A steady, continuous circulation of oil is assured.

Perpetually Clean.

Hyatt roller bearings are "dirt proof." The rollers are never worn away by particles of grit, because they clean themselves automatically while running. The dirt particles on the roller surface are forced through the spiral slot to the hollow inside. They cannot escape meeting this spiral slot, as the roller turns. "Grit grind," the cause of 95 per cent. of all wear in bearings, is never present in a Hyatt bearing.

Never Need Adjusting.

Some bearings are made adjustable. Naturally, it is expected they will need adjusting. Such a bearing is at the mercy of every inquisitive mechanic who finds the opportunity to tamper with it. Even those who are most competent sometimes go wrong in making the adjustment, causing additional trouble and unnecessary expense for the car owner.

Why should bearings need adjustment at all? The obvious reason is to take up the wear they have suffered. Unnecessary wear means more frequent adjustments. One wrong adjustment means a new bearing and possibly new gears—a new axle—or other new parts.

It was learned that the natural wear of bearings could be so reduced that no adjustment was necessary even after enormous distances had been covered by the truck of which they were a part. The little wear which is bound to occur could be reduced to an absolute minimum.

That is exactly what the Hyatt Roller Bearing Company has done. The flexible feature of the hollow roller causes the bearing to suffer no harm from sudden bumps and jars. A steady flow of oil and a clean bearing surface makes rapid wear impossible. The material from which the bearing is built is of the greatest wear-resisting qualities.

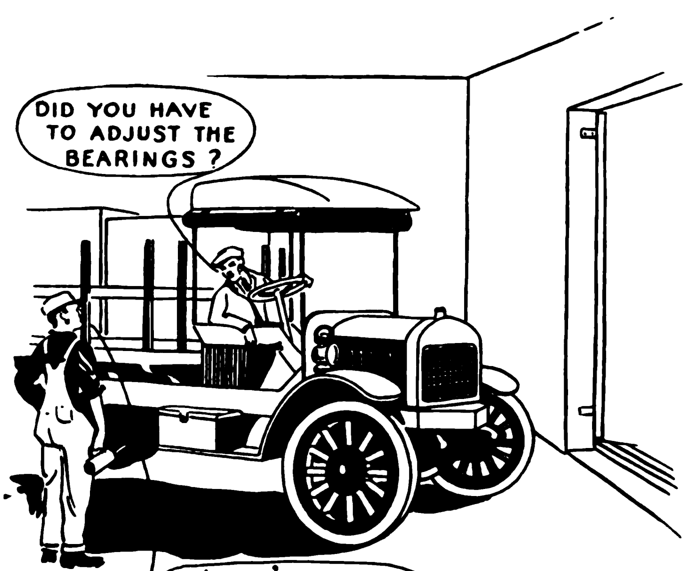
It has been found that in many Hyatt bearings which had seen thousands of miles of service, the wear they had suffered was imperceptible in fact, they were good for many more miles of running. These are not isolated cases which might be accounted for under the old "exceptions to all rules" belief. They are not exceptions. Such records are the rule.

The Maintenance of Quality.

The high duty type of bearing is a development. It is the culmination of a long period of study, experiment and experience.

Special steels of different analyses were selected. Each was subjected to various heat treatments. The product of each process was carefully examined and tested until finally a hard, wear-resisting material was evolved which was highly elastic, and one in which crystallization and the possibility of breakage was entirely eliminated.

To insure the maintenance of this high quality in the product, exacting metallurgical and physical tests are made of the raw material. Samples are taken from all the raw steel received. Not only must the samples meet the tests made in a fully equipped physical and chemical laboratory, but a number are carried through the entire heat treatment in order to insure that the



There Is No Reason for Adjusting Bearings When the Machine Is Equipped with Hyatts.

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best results are being achieved in the manufacturing process.

But the inspection does not end there. The most competent and careful supervision has been established. Electrical pyrometers make it possible for technical experts to watch and govern the temperature of every furnace. Wonderful testing equipment determines the physical properties of the material in every state of the manufacturing process. Any irregularity is corrected immediately. A high standard has been set and that standard is constantly being maintained.

Proof of the Pudding.

After all, performance is the acid test. Claims are easy to make, but sometimes hard to substantiate.

Tests and experiments have shown that Hyatt roller bearings were exceptionally well adapted for the work they were expected to do. But tests and experiments, no matter how complete, could not duplicate the conditions of actual service. **So actual service records were obtained.** They showed conclusively that Hyatt roller bearings, properly designed and built into a truck, **could be depended upon to outlast the truck itself,** if given only ordinary attention.

The principle of the Hyatt bearings is correct. Its development is thorough. The greatest possible care is exercised to assure uniformity in manufacture. Quality is the great consideration.

Working under normal conditions no bearing gives better service. But even when overloaded, abused, imperfectly aligned and improperly mounted—the owner will be astonished at the consistent, dependable performance of Hyatt roller bearings.

BOOK ON AUTOMOBILE SPRINGS.

A book thoroughly covering the subject of automobile springs in all details has been published by the Detroit Steel Products Company, Detroit, Mich. This gives in a popular, easily understandable way, the history of spring construction and a thorough discussion of all the technical considerations that enter into every phase of modern spring making, their design, lubrication and the metallurgy of the steels that are used in their construction. Factory methods of construction are also treated. The book is extremely readable and should greatly interest everyone who seeks knowledge of the details of an important factor in automobile design and construction.

Henry Jossman has been appointed sales manager for the Columbia Truck and Trailer Company, which recently moved to Pontiac, Mich., from Kalamazoo. He was formerly with the Oakland Motor Car Company.

J. D. Cotton has been appointed advertising manager of the Four Wheel Drive Motor Company of Clintonville, Wis.

COST OF FREIGHT TO ENGLAND.

The Shakespeare Motor Company, Ltd., of London, which builds trucks in the United States for importation into England, has given a British trade paper an insight into the cost of shipping the trucks from this country and delivering them there. It recently shipped three two-ton chassis to London at the following cost:

Inland freight to New York	$111.37
Insurance	102.00
Handling in New York	27.50
Total in America	$240.87
Shipping freight	$647.75
Entry clearance, unloading and unpacking	83.12
Total in England	$730.87
Total	971.75
Per truck	$323.91

Although the vehicles with their crates weighed only nine tons, the company was charged for 40 tons, on the basis of bulk, as 40 cubic feet is reckoned as one ton. These freights are abnormally high at present owing to the war. Yet that these extra expenses even without a tariff are a substantial handicap to American producers seeking a market in England is evident.

FOUR SIZES OF AUTO TRAILERS.

H. C. Randolph of Jonesville, Mich., successor to the Standard Auto Trailer Truck Company, has begun the manufacture of trailers. These are sold for $45 upwards, according to load capacity, the kind of tires and the kind of axles. The trailer with 1000-pound capacity has 1⅛-inch steel or rubber tires, that of capacity of 1300 pounds has 1¼-inch steel or rubber tires, and that of a load capacity of 1600 pounds has 1⅜-inch steel or rubber tires, while 1½-inch steel or rubber tires are used for the trailer that carries 2500. The body is six feet 10 inches long, 38 inches wide and seven inches deep. The net weight of the trailer is 350 and the shipping weight 425 pounds.

WESTERN TIRE AND RUBBER COMPANY.

The Western Tire and Rubber Company of Kansas City, Mo., has reorganized under the laws of Ohio and is building a factory in Akron, where its line of tire accessories will be made and in addition 400 tires a day will be turned out. The company is styled the General Rubber Company and its capitalization is to be $200,000.

The Duplex-Power Car Company of Charlotte, Mich., has re-elected its officers. They are Frank P. Town, president; Frank E. King, vice president; Horton H. Bryan, treasurer, and M. J. Lamson, secretary.

For the second time this year the stockholders of the Republic Motor Truck Company have voted to increase the capital stock of the company. It is raised this time from $250,000 to $500,000.

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UTILITY OF THE COMBINATION WRENCH SET.

By F. E. CHASE, Advertising Manager, Frank Mossberg Company.

"NECESSITY is the mother of invention." It is an old saying and a mighty true one, and may be very nicely applied now to combination wrench sets or socket wrench sets as some prefer to call them.

A short 10 years ago this type of wrench set was in its infancy, but so also were motor vehicles, motor boats and innumerable other kinds of engines and machinery.

Gradually, year by year, you have witnessed the wonderful development along these lines. Perhaps the development has been more noticeable to the general public in the varied and complicated types of automobile and motor truck engines.

As these powerful little motors have increased in efficiency from year to year, their construction has demanded the placing of nuts and bolts in more and more inaccessible places, where they could not be reached by the ordinary type of wrench. Hence the necessity arose of devising wrenches which would reach these places quickly and efficiently, and as a result, we find the modern combination socket wrench set.

The increasing demand brought many styles and assortments.

The essential parts which go to make up the combination wrench set of today may be divided roughly as follows:

Hexagon and square sockets, handles to fit these, of various kinds and sizes; extension bars of different lengths and types, a universal joint, screw driver bits of different sizes and a very complete set of double end open end wrenches.

In some cases, pliers, a drill, an alligator wrench, an adjustable wrench and a cotter pin puller have been added. And in event of sets being especially intended for gasoline engine work, spark plug sockets are usually added.

Concentrated efficiency, simplicity, strength and accuracy of design, together with the "get-at-and-fit-the-nut" feature, have ever been the key note of the successful combination wrench set manufacturer.

Construction.

The sockets are perhaps the most essential part of a set of this kind, and care should be taken in selection, to see that these are of the thin, drawn steel type, as in modern engine construction, nuts and bolts are often found imbedded in places that will not admit of more than ⅛ inch to 3/16 inch clearance. Thus it will be seen that the old style heavy cast or forged sockets are useless in such cases.

In some instances, to gain clearance, it has even been found necessary to taper the socket at the head edge, as is the case in order to properly fit the rear axle housing and cylinder base nuts on Ford cars.

Tension springs and spring tension balls are a necessary adjunct to the well ordained combination wrench set of today, as it is not enough that the parts should go together readily and efficiently, but quite as important that when they are once adjusted they should "stay put" and not drop apart at an inopportune moment.

Socket manufacturers usually allow 1/32 inch clearance between the inside of the socket and the nut it is intended to fit, and as the pressure is equal on each face of the hex or square, as the case may be, it is reasonable to assume that this class of wrench is more effective than the ordinary kinds which grip only two surfaces of the object.

A Typical Combination Wrench Set for Garage or Service Station Use. Adequate for All Classes of Work.

Best results will follow if sockets are used only on the correct sized nut or bolt for which they are intended. Should the nut be too small, it is liable to split the best socket that can be made. This, in justice to the manufacturers who are striving to maintain an absolute guarantee under all conditions.

Perhaps next in importance is the ratchet or friction handle, as the case may be, into which the sockets and extension bars fit snugly and are held firmly in place by means of a little tension spring.

Many types of socket handles are in the market, but the 10-inch pressed steel reversible ratchet handle seems to be perhaps the most popular with mechanics, there being practically no lost motion in operation.

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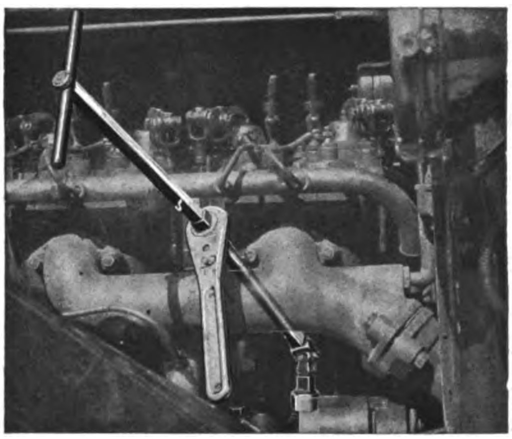
and the ratchet is positive.

The extension bar is so constructed that one end will take the various sizes of sockets so that when it is connected up with the handle the operator is enabled to reach nuts and bolts which could not be gotten at by the short reach of the socket and handle alone.

To still further augment the usefulness of this handy little contrivance, the universal joint may be added to the further end of the extension bar, this being held firmly in place by means of a small steel ball and tension spring, and taking the socket at the extreme end in a like manner, one may now reach around a corner, so to speak, or reach a nut or bolt which would otherwise be impossible to get at.

The screw driver bits are by no means an unnecessary adjunct to this resourceful little outfit, and in the case of the combination here illustrated, this little bit binds firmly into the end of the extension bar, and this when connected up with the handle, forms a complete ratchet screw driver.

While it is always possible for one to get any and all parts of sets which may be best adapted to his particular needs and thus make up his own set, nevertheless, manufacturers have spared no pains in making up carefully selected sets which will meet almost any emergency.



Illustrating the Wrench Adapted for Working at Angles in Space Too Limited for a Straight Leverage.

It is an old adage that "the proof of the pudding is in the eating," and thus it is that the vast uses of these combination wrench sets, brought about by the ever increasing complexity of engine construction, causes them to be found in every well equipped shop and garage in this country and abroad today.

They are practically indispensible to the owners and operators of motor trucks, automobiles, motorcycles, motor boats, flying machines and gas and gasoline engines.

They are also very useful aids to constructors of steel bridges and buildings, etc. In fact the only limitation that might be placed upon these wonderful little sets would be a class of construction that does not require nuts or bolts, and even then, we find the ratchet screw driver for the carpenter and builder.

TRUCKS WILL CHEAPEN RATES.

Development of Water Freight Lines Practical by Motor Truck Haulage.

In every part of the country the competition of the railroads has been disastrous to the steamer lines that once plied the rivers. Great cities built on water ways in the days when steamers carried immense volumes of freight have not developed consistently and have not made consistent progress since the railroads have carried the freights.

But in the motor truck the river steamer lines have found an ally which W. D. Dobson, secretary of the Trade and Commerce Bureau of Portland, Ore., thinks may restore the inland water way traffic to some of its early importance if it does not make vast new development possible.

"All students of traffic know that the river has failed as a freight carrier because its service stopped at the bank. Such freight as lay beyond the bank was not available owing to the expense of hauling by team. To make the entire distance by railroad on cars loaded nearby was cheaper," he said in a recent talk to the Automobile Trade Association of Portland.

"Although the river haul has always been much cheaper than the railroad, that saving was more than absorbed by the expense of getting the goods to the river and getting them away from it again at destination. The railroads naturally resisted to the last any effort to make them give low rates for short runs to river points to build up a feed system for river transportation, and thus give aid and comfort to a competitor.

"But the motor truck is changing all this. It has shown that for short distances it can compete with electric or steam lines and even with river transportation in cost. Wherever hard surfaced highways go the motor truck follows with low rates, quick service and the most adjustable form of land transportation yet devised to serve as a feed or distributive system.

"The truck has great importance for Portland. It has come just at a time when the Columbia river has been fully opened to navigation. A part of the big plan for the development of traffic on the river is to build paved highways to wharves along the shore and put on these motor trucks which will carry the freight of the merchant, the farmer, the dairy man and the truck gardener, to and from the steamers. On the banks of the river are to be modern handling devices to give the lowest costs for transfer and for storage."

Gasoline continues to rise rapidly in all parts of the country, as the demand has taken the stored supplies of crude oil which were in stock in the producing fields early in the year. It has now reached 23 cents retail in New York City, the highest point in the country, although increases have been made in price all over the country.

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POWER WAGONS BEST FOR ALL-CITY HAULAGE.

Four-Year Study of Transportation Equipment and Methods by Massachusetts Institute of Technology Shows That in Existing Conditions Trucks Are Most Economical.

A STUDY that continued over four years and treated with great detail the conditions, results and costs of hauling in cities by horses, electric and gasoline trucks, has just been made public by the Massachusetts Institute of Technology. The work was done by Harry F. Thompson of the electrical engineering department of the school, and was financed by the Edison Electric Illuminating Company of Boston.

The most significant conclusion from the standpoint of those interested in trucks is that trucks can and do even under the present imperfect conditions yield results equal or superior in economy to horse service in every sort of haulage, with the single exception of deliveries of bulk goods within a two-mile limit.

In view of the fact that transportation systems have not yet been adapted to mechanical haulage and that many of the arrangements and methods are still those that developed with or were adapted to horse delivery, this indicates that the horse will be practically eliminated from city delivery when haulage conditions come to be more fully adjusted to the requirements of the truck.

Four Years of Investigation.

In preparing the paper the work continued over four years, from 1911 until well into 1914. Detailed studies of hundreds of haulage systems were made in the city of Boston. Tape recorders were attached to vehicles of all types and these were figured up against detailed cost records and records of work done which were made by the concerns operating the trucks. Many instances were also secured from other large cities, not only in the East, but all over the country.

Conditions and results were found to vary greatly, but a general average of all the performances was taken by means of curves and on these general averages the conclusions of the report are based. While the variation in individual experiences shows that they cannot be taken as infallible guide to the results of truck operation, they constitute a much more reliable basis than has previously been available for estimates on the subject.

That part of the study relating to the comparative value of hauling methods is divided into three sections—one relating to parcel delivery, such as a department store must handle, another to bulk goods, of which coal is typical, and a third to freight hauling between stations and warehouses.

Delivery of each sort was divided into three classes on a basis of distance—one zone within two miles of the loading points, one from two to six miles, which is about the limit of electric operation on a single battery charge a day, and one beyond six miles.

The summary of results shows that within the two-mile zone the conomy of horse drawn and electrical vehicles is substantially the same; from two to six miles, or the limit of its effective use, the electric is cheaper than the horse and the gasoline truck; that at eight miles the gasoline truck becomes more economical than the horse, and that beyond the range of the electric the gasoline vehicle is at present the only economical means of delivery. See Fig. 1.

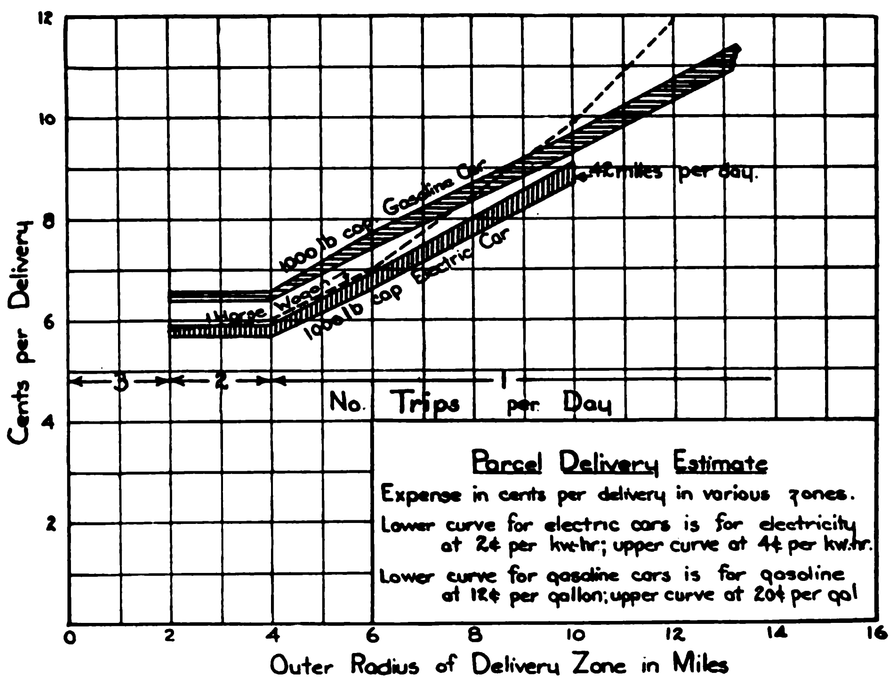

Fig. 1—Plot of the Estimates for Parcel Delivery Covering One or Several Routes a Day.

Fuel Cost Minor Item.

To take care of variation in the price of gasoline or of electric current, these curves were plotted to show results with electricity costing two cents per kilowatt-hour and four cents per kilowatt-hour, and gasoline costing 12 cents and 20 cents a gallon. As the cost of energy is only from six to 10 per cent. of the total cost of operation, these changes in price are shown to have little or no effect on the comparative economies.

In the case of bulk goods, the two-horse truck is shown to be cheaper on deliveries in the two-mile zone than either the five-ton electric or five-ton gasoline

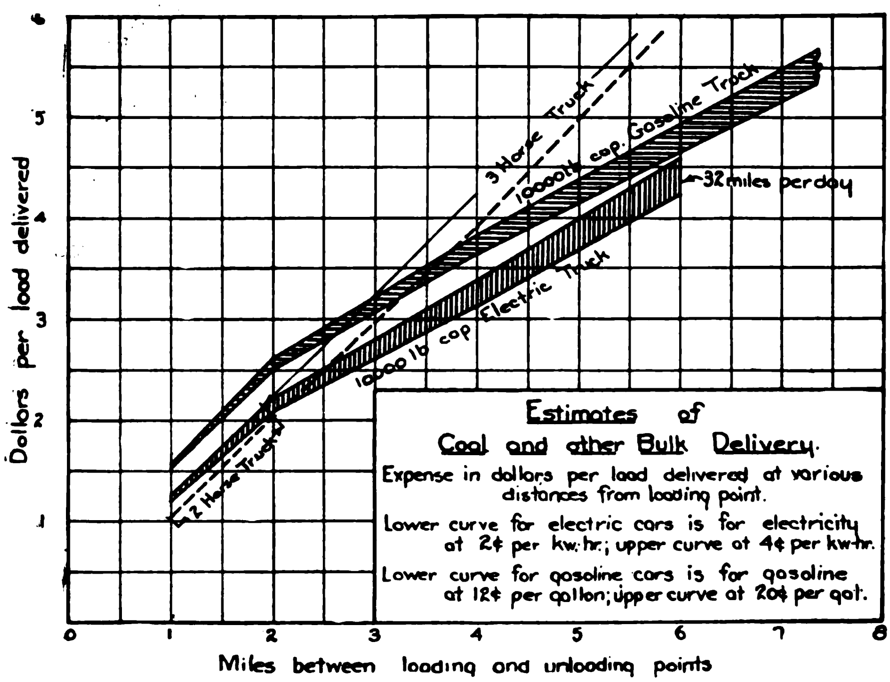

Fig. 2—Plot of the Estimates Made for the Delivery of Coal in an Urban Business.

truck; at two miles the electric becomes the cheaper and continues so to the limit of its range of operation, and at 3½ miles the gasoline truck becomes cheaper than the horse. See Fig. 2.

In the case of freight hauling to and from stations, the comparisons are made between a two-horse team and a two-ton electric truck. The cost per trip is shown to be substantially identical. If it were possible—and no doubt it is—to reduce the average standing time at warehouses from .7 to .4 of an hour and at the station from an hour to .7, the electric truck would show a saving of seven cents per trip.

The report indicates the opinion that the economical zone of the electric truck could be extended in both directions by intelligent effort. It could be made more efficient on short hauls by reducing standing time, and more efficient for longer hauls by the use of boosting equipment for recharging the batteries, or by the battery exchange plan.

The investigation of the general conditions of city haulage disclosed nothing that has not been generally known by truck men. It indicates that the expense estimates made by many truck manufacturers have been proved by an average of actual expenses of many operators to have been in general too low, but this has not greatly effected the comparative economy, as the careful analysis of horse costs made has shown horse expense to be generally higher than most horse operators have supposed, if indeed, they had any reliable knowledge on the subject.

The average mileage of a horse over city pavements is shown to be about 15 miles, though some do 18 or 20, and may for short periods do 25 miles. The average speed of horse travel is about four miles an hour, so that if he does 15 miles he is actually in motion only 3¾ hours and is standing 6¼ hours.

As a result of this the arrangements for loading and unloading have been such as to consume about the time the horse needed for rest in loading and unloading. If the rest time were cut down it would be necessary to change horses in the middle of the day and that would offset the saving made by the more steady operation.

The two inherent advantages of trucks over horses are that they move faster and that there is no physical tiring of motive power. In many instances the truck is more economical than the horse, even operating under the horse conditions of long standing time, and as standing time is reduced truck efficiency increases.

As long as horses were the only means of hauling most firms regarded the delivery system as a necessary evil and gave it very little supervision or attention, and were often ignorant of haulage costs. Some trucks were at first operated with the same carelessness, but the tendency of truck operation has been to increase the degree of supervision given to both truck and animal hauling.

The adjustment of conditions to the needs of the motor truck has made much progress with chutes and dump bodies for bulk goods, crate bodies, interchangeable bodies and so on. The use of a speedy vehicle, such as a truck, has had a psychological effect on the

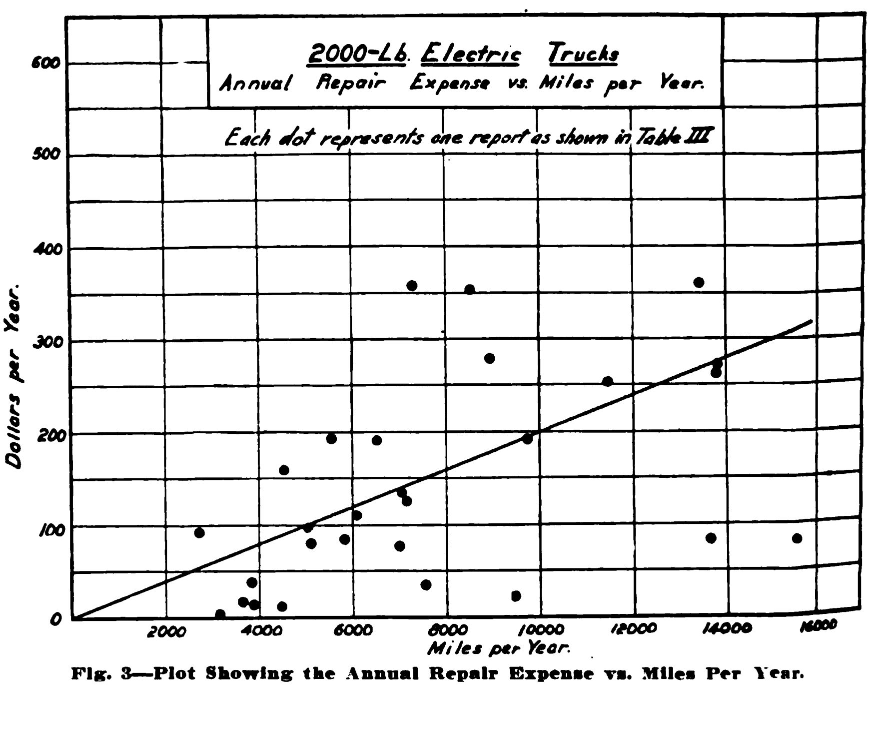

Fig. 3—Plot Showing the Annual Repair Expense vs. Miles Per Year.

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men which speeds them up as compared to the way they work with horse teams.

Conditions in the haulage of freight from stations, warehouses and stores were found to be very inefficient. Much time was lost at the freight station, but considerably more at warehouses, because goods were not ready or elevators were busy or some similar cause. Another great source of loss lay in the fact that many of the vehicles ran with only part of a load for much of the working day.

The time studies showed that an average of 29 minutes was required to unload at the freight houses, as compared with 38 minutes at the warehouses. The average loss of time in waiting for a platform at the Boston freight stations was only 10 minutes a day.

A study of the loads carried to and from the stations in New York and Boston indicated that the horse rigs were usually loaded to only one-half of what they could have carried. A system by which all trucking would be done by the railroads or by a single trucking organization might eliminate much of this waste, but is probably impossible at this stage of development.

Suggestions for truck operators drawn from this part of the truck investigation, are given as follows:

The work of a truck should be routed with a view to avoiding idle standing time and unnecessary retracing of the route.

Every reasonable effort should be made to keep moving; in operating a mixed system of horses and motors, it should be remembered that a motor represents more investment and more earning power than a horse wagon.

The mechanism of a truck should be carefully inspected at least once in two weeks and a written report thereon made to the superintendent.

A truck should be entirely overhauled once each year in order that worn parts may be located and replaced.

All abuse of a truck, especially overloading and overspeeding, should be prohibited.

The interest of the driver in the condition of his machine should be promoted, as the vehicle is furnished by the company to assist him in performing his work; so far as possible a certain machine should be assigned to each driver.

An accurate record should be kept of cost items and performance for each truck; this will assist in arranging the work of the vehicles; it will stimulate the driver to his best effort and it will be valuable in any discussion with the manufacturers of the trucks or their equipment, which may logically be expected.

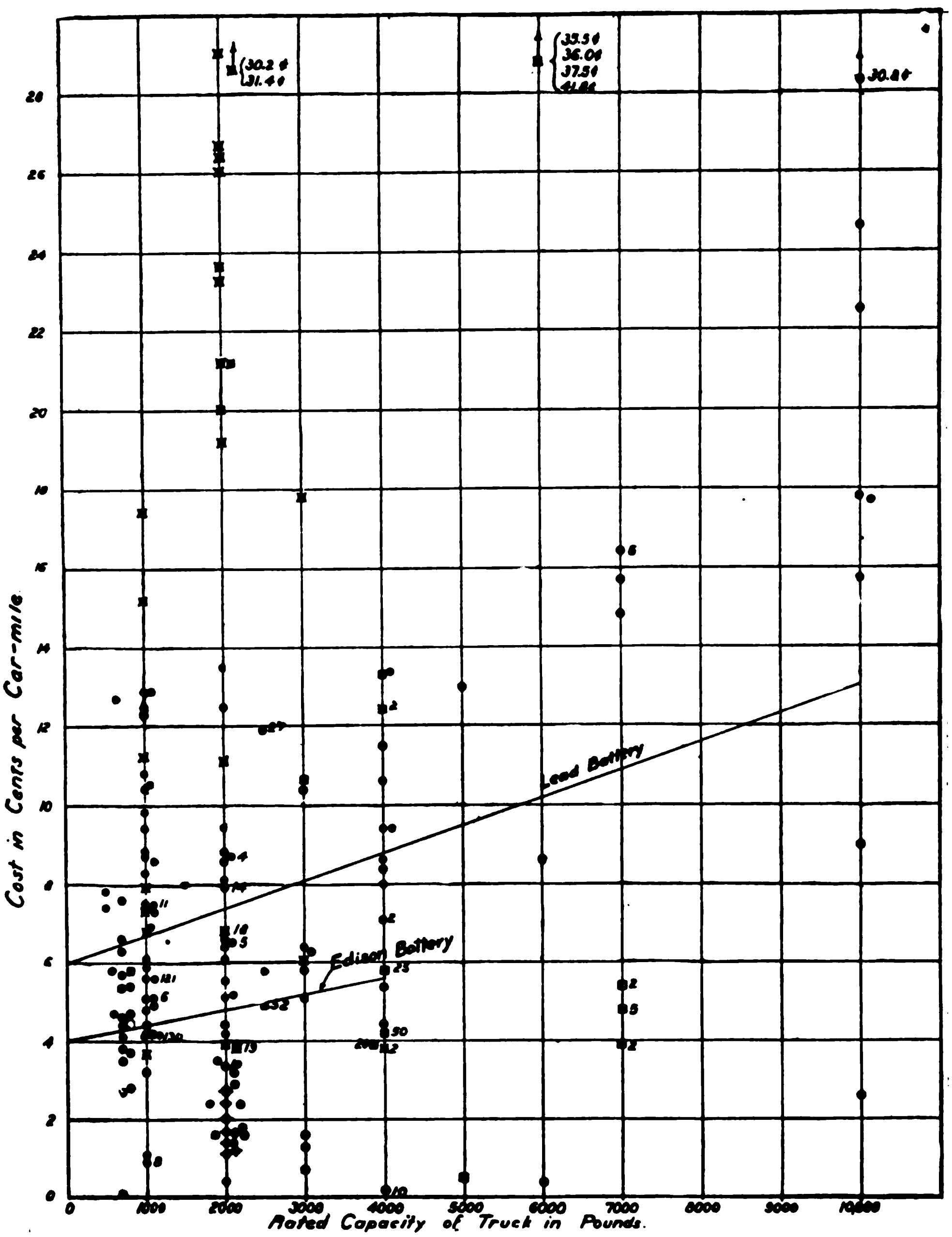

Fig. 4—Electric Truck Maintenance Expense, Including Lubricants, Tire Renewals, Battery, Repairs and Painting: Black Circle Represents Lead Battery with Pasted Plates; Point Within a Circle Represents Edison Battery; Point Within a Square Represents Ironclad-Exide Battery; X, Trucks More Than Fours Years Old When Reported; Cross, Trucks Less Than Six Months Old When Reported; Numbers Refer to Number of Trucks Represented by the Point.

A wide canvass of truck users was made to secure cost data. This canvass covered 32 companies, operating 780 electric trucks, 41 companies operating 401 gasoline trucks and 54 companies using 5787 horses.

In the analysis of this cost data, to arrive at a rep-

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resentative or average expense, it was sought to establish the extent to which each expense item for a given period, say one year, varied with the distance travelled by the truck during the year, the age of the truck at the close of the period, the number of days the truck was operated during the period. Some items, such as tire expense, depend on the distance travelled; others, such as labor, on the number of days the truck was operated. Such items as tire renewals, repairs, painting and battery renewals were included under the term "maintenance expense."

This analysis as shown in the curve of Fig. 3, showed that maintenance on the whole varied directly with mileage. This is not true where the mileage is either very low or very high for the year, but for ordinary use under ordinary conditions it was found to be approximately correct.

In several instances reports were had upon the same truck or trucks at different periods in their age, so that comparative maintenance expense for several years could be judged. In the case of electrics this led to the conclusion that maintenance expense steadily increased during the first 18 months of the car's age, and then remains practically constant up to four years, which was the limit of the investigation. With gasoline cars the maintenance expense was found to increase steadily for the first three years and then more slowly for the fourth year.

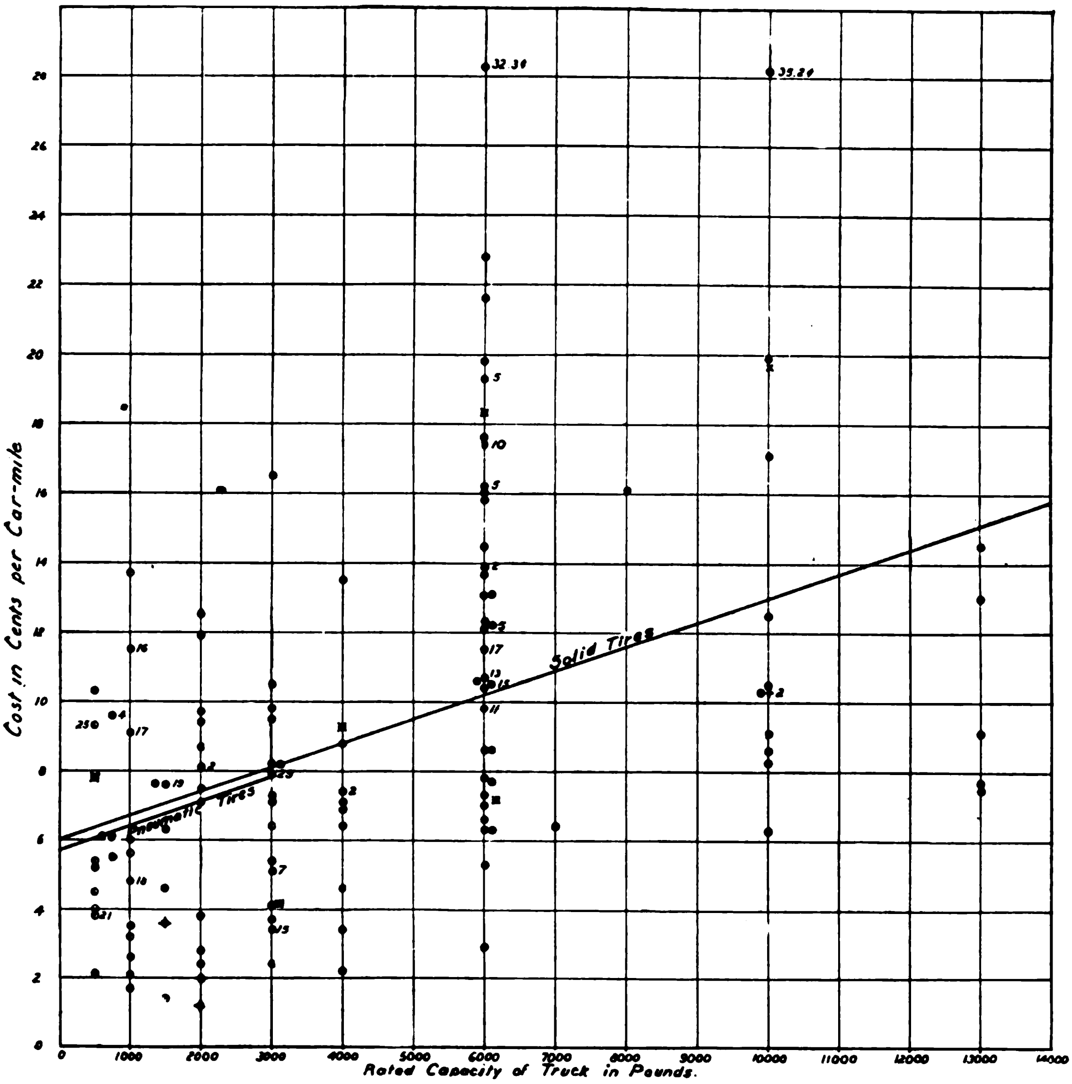

Fig. 5—Gasoline Truck Maintenance Expense, Including Lubricants, Tire Renewals, Repairs and Painting: Black Circle Represents Solid Tires Used; Point Within a Circle Represents Pneumatic Tires; X, Trucks More Than Four Years Old When Reported; Cross, Trucks, Less Than Six Months Old When Reported; Numbers Refer to Number of Trucks Represented by the Point.

Maintenance Cost Per Mile.

The average cost of maintenance per mile was then plotted for both electric and gasoline trucks of various sizes. As shown in Fig. 4, maintenance is considerably more with electric trucks if lead batteries are used than if Edison batteries are employed. The figures are with Edison batteries: 1000 pounds capacity, 4¼ cents; 2000 pounds capacity, five cents; 3000 pounds capacity, 5¼ cents. With lead batteries the results were: 1000 pounds, 6 1/3 cents; 2000 pounds, 7 1/3 cents; 3000 pounds, eight cents; 4000 pounds, 8 2/3 cents; 5000 pounds, 9½ cents; 6000 pounds, a fraction more than 10 cents; 7000 pounds, 11 cents; 8000 pounds, 11 2/3 cents; 9000 pounds, 12 1/3 cents; 10,000 pounds, 12½ cents.

In securing averages for gasoline driven vehicles, trucks equipped with pneumatic tires were differentiated from those with solid tires, as theoretically the cushioning effect of the pneumatics should save the mechanism and reduce maintenance expense. The difference was found to be for different sizes an average of three-tenths of a cent a mile.

The following figures are for gasoline trucks with solid tires and represent the average of all the data collected: 1000 pounds, 6¾ cents; 2000 pounds, 7½ cents; 3000 pounds, eight cents; 4000 pounds, nine cents; 5000 pounds, 9½ cents; 6000 pounds, 10¼ cents; 7000 pounds, 11 cents; 8000 pounds, slightly less than 12 cents; 9000 pounds, slightly more than 12 cents; 10,000 pounds, 13 cents. See Fig. 5.

The proportions of repair expense chargeable to labor and to cost of parts were found to be 45 per cent. for labor and 55 for parts in gasoline trucks and 49 per cent. for labor and 51 for parts with electric trucks.

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Watt hours consumption per truck mile for electrics and mileage per gallon of gasoline for gas trucks were also platted with the following results for electrics:

With lead batteries: 1000 pounds capacity, 550; 2000 pounds capacity, 630; 3000 pounds, 750; 4000 pounds, 825; 5000 pounds, 850; 6000 pounds, 1025; 7000 pounds, 1125; 8000 pounds, 1225; 9000 pounds, 1375; 10,000 pounds, 1400.

With Edison batteries the averages were: 1000 pounds, 675; 2000 pounds, 900; 3000 pounds, 1025; 4000 pounds, 1200.

Mileage Per Gallon.

Gasoline trucks of 1000 pounds showed nine miles per gallon; 2000 pounds, 7½ miles; 3000 pounds, 6 1/3; 4000 pounds, 5½; 5000 pounds, five; 6000 pounds, 4½; 7000 pounds, a trifle more than four; 8000 pounds, 3¾; 9000 pounds, 3⅝; 10,000 pounds, 3½.

Depreciation averages showed that 12½ per cent. a year for an electric, which is based on an average life of eight years, is about right, while for gasoline trucks, 20 per cent., on a basis of a five-year life, is also approximately correct.

In connection with the figuring of depreciation, Mr. Thompson takes the position that if the interest charge is figured on the cost of the truck with tires and battery, it should be charged on only half the investment. If it is taken on the investment minus the cost of one set of tires, about .5 per cent. should be added to it.

A reliability record arrived at by computing the number of days a year in which trucks were in service when they were needed and ignoring Sundays and holidays, showed an average of 290 days for the electric as against 275 days for the gasoline car.

One of the most interesting sections of the report is that dealing with average horse costs. Such costs have been almost unknown, because so few firms have kept them, and those given here were arrived at by making special arrangements with horse operators to attach tape recorders to their wagons and keep special track of expenses according to the form supplied by the investigators.

For the purpose of analysis horse service was divided into three classes: Bulk goods service, mostly two-horse rigs; parcel delivery service, mostly one-horse rigs; basket delivery service for small groceries, meat markets, etc., and government service, federal, state and municipal. Horse and wagon expenses are separated.

The expense per horse per year was found to be $295 in bulk hauling; $312 in parcel delivery; $303 in basket delivery, and $485 in government service. Expenses per wagon per year were found to be $112 for bulk goods; $103 for parcel delivery; $91 for basket delivery. No figures on wagons in government service are given.

A typical account for a horse costing $305 a year was divided as follows: Shoeing, $34; veterinary, $6; feed, $190; stable expense, $75. The large excess cost in the government figures is due chiefly to the expense of stable labor, the cost of labor being much larger.

It was found practically impossible to establish an average useful life of a horse as a basis on which to figure depreciation for the reason that practically all city operators are constantly buying new stock and selling their old horses.

A basis for the depreciation figure can be arrived at, however, by comparing the average net expenditure for new horses each year as compared to the value of the stock in the stables. An average based on a large number of instances indicated that an expenditure of about 25 per cent. of the value of the stock every year was necessary to keep the animals in good condition for efficient service, and that leads to a depreciation charge of 25 per cent. A similar annual allowance for the replacement of wagons indicated that 10 per cent. a year was a reasonable figure for depreciation.

HENRY FORD & SON TO MAKE TRACTORS.

The company which will produce the Ford tractor at the new plant at Dearborn, Mich., will be known as Henry Ford & Son and no one outside of the Ford family will hold stock in it. A large part of the profits of the enterprise will be divided up between the workmen and the people who buy tractors. Mr. Ford will invest $1,000,000 in the business to begin with. The old factory buildings on the land are being torn down and new ones 160 by 800 feet will be built. The pattern shop and the power house are already nearly completed.

FOUR SIZES OF GARY TRUCKS.

The Gary Motor Truck Company, Gary, Ind., is producing ¾-ton, one-ton, 1½-ton and two-ton trucks that are alike in design, except as to size of parts. Buda motors are standard equipment and all the trucks are worm drive types, with left side steer and control. Eisemann high-tension magnetos and Stromberg carburetors are used. Other mechanical details include dry disc clutches, three-speed selective transmission gear sets, two universal joints for the main housing shafts and Goodyear S. V. truck tires.

Two concrete and brick additions to the plant of the Simms Magneto Company, Bloomfield, N. J., are under construction. One building, 42 by 70 feet, will contain the grinding and dipping departments, and the other, 72 by 90 feet, will house the storage and shipping departments. More machinery will be installed in the main plant. The entire output is contracted for until well into 1916.

The Ohio Motor Company has been formed at Canton, O., to build motors for trucks, tractors and aeroplanes, as well as other motor vehicle parts. A factory building 60 by 600 feet is to be erected. The capital is $500,000, of which $200,000 is paid in.

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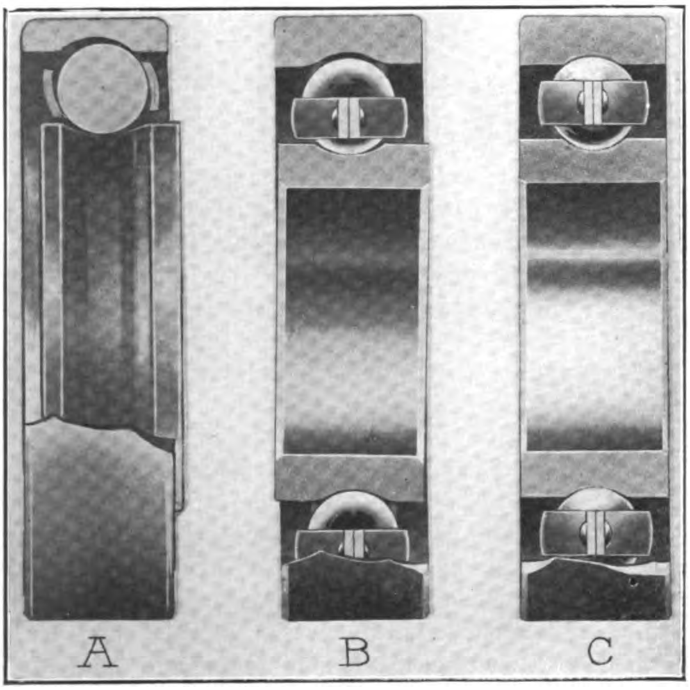
SCIENTIFIC REPAIRING OF BALL BEARINGS.

By W. C. BENDER, Sales Manager, Ahlberg Bearing Company.

THE regrinder of bearings, due to his experience in the handling of worn and misused bearings of all makes and types, is no doubt more capable of explaining the many reasons why bearings are sent to the grinders, and the abuses which perfectly constructed ones that are sometimes complained of as faulty are forced to stand. Many causes and reasons for bearings giving way can be mentioned, but it is the purpose of this article to give to the user, the builder and the garage man or mechanic who remounts the bearings, the high lights and essentials gained from an experience with this important part of all machinery.



Effects of Wear and Result of Restoration: A, Inner Race, Balls and Ball Retainer Off Centre from Adjustment; B, Inner Race and Retainer Dropped and Out of Alignment; C, Bearing After Regrinding and Fitting of New Balls.

To start with, it may be best to inform the interested reader what is done and what is not done during the regrinding of the bearing. I will start with what we do in the regrinding. In putting a bearing in "as good as new" condition every reliable grinder must regrind the raceways so that the proper fitting can be made and the bearing allowed to perform its duties without a "hitch," which often is the case when not properly ground. New balls must be inserted and new retainers used where necessary. If all these things are properly and correctly done, the bearing should be returned to the owner not only as good as new, but should perform all the duties, and at the same time give to the owner of the machinery, or rather automobile, as much service as a new bearing.

In regrinding it is more than essential that special care be taken that the outer diameter is not changed or altered—not even to 1/1000 of an inch. The same applies to the inner diameter and width. We have found in our grinding that it is the opinion of many interested in the trade that the size of the bearing is changed in grinding. This is not only untrue, but absolutely impossible by the method used, and if a bearing was changed in size it would not only work to a disadvantage when remounted, but would give trouble. The owner and mechanic must be assured that no change is made and that this belief is without foundation.

Before giving the causes and reasons for bearing trouble, I think it best to continue with the remounting of the bearings and why the raceways are pitted.

In remounting, too much effort cannot be placed upon cleaning the bearing. The presence of any foreign substance in the raceways will cause a great deal of trouble and again leave the car with a faulty bearing. In remounting, the lubricating is in all probability one of the most important fundamentals in the life of the part. Not only should the correct amount of lubrication be used, but care should be exercised in the selection of the lubricant.

Materials Carefully Selected.

The manufacturers of bearings make the rings of a tough, special bearing steel hardened throughout and selected by experts who made certain that it has stood every test. This, to my way of thinking, is the only manner possible to absolutely guarantee the proper life of bearings.

In our experience it has been shown to us that the greatest cause for wear is due to mismounting and improper lubrication rather than faulty material and poor workmanship. A good mechanic using the right care and feeling the pride that goes with correctly performed work, should never have a bearing improperly remounted. It is a task that does not require expert workmanship nearly as much as careful workmanship, and I have attempted to impress this upon all users that I have had the pleasure to come in contact with.

Care in the Selection of Bearings.

Before the purchasing of bearings, the greatest of care should be used in the selection of the bearing, so that one can feel certain that the load and speed required will not wear down the bearing. Too much stress cannot be laid upon this point, as many times bearings will be misjudged as faulty in materials, which gives a black eye not to the man who makes the bearing, but the expert responsible for the selection.

Every effort should be made to keep the housing of the bearing fool proof. This is one point which, I believe, is practised by the manufacturer of every part

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which goes into a motor truck or pleasure vehicle. It should be the duty of the builder to be positive that the bearing has sufficient shoulders for the inner and outer rings so as to make it almost impossible, if not impossible, for a nut to be turned up a little too far, causing the rings to offset.

Ball Should Only Touch at Centres.

This we find is one of the greatest troubles in keeping bearings from wearing. The balls should touch only in the centre of each raceway. It can be readily realized that the offsetting of the rings will cause the bearing to bind or a ring to crack, or force the balls to roughen and pit the surface of the raceway, thereby producing a vibration that will be noticeable throughout the car.

It is necessary that a bearing be thoroughly cleaned and lubricated before installing, as particles as fine as graphite will bind and roughen the raceways. Even the most careful mounting could not prevent a bearing from suffering severely sooner or later if proper attention is not given to maintaining permanently the properties of the lubricant, the exclusion of grit and the cleanliness of the housings.

The only lubricant suitable to meet all ball bearing conditions is a product free from all acid, alkali or foreign matter.

Final Test Is in Service.

In the manufacturing of a bearing the very highest grade of steel is used. This steel is treated to gain the highest efficiency and stand the entire load of the automobile. The steel, before it meets the O. K. of the man selecting the material, must pass all of the tests which have been designed by our greatest engineers before it is approved as to proper grade to be used in the construction of bearings. However, the best is none too good and in many cases this careful selection is not an assurance that the steel is free from all defects.

The one and only real test for any bearing is under working conditions when the turning of the corners at a higher speed than necessary throws the entire weight upon one bearing without distributing, and forces a twisting, which to my knowledge the majority of bearings stand up under. But a short distance is not enough to test a bearing and test the steel which the part is made of—the car should be run under the most strenuous conditions for several thousand miles. Then the steel has received a test sufficient to bring out any defects and by regrinding the worn raceways and inserting new balls the bearing is given a new life with the guarantee that the risk of defective rings is eliminated.

Saving of Time and Expense.

The regrinding of bearings naturally means the laying up of the machine in many cases and this is sometimes the cause of an owner putting off regrinding until it is absolutely impossible to bring back to life the worn and abused bearing without excessive work. To obviate the owner of the machine losing the time necessary to have a bearing reground, and to save him the money which he would expend in laying up his truck or car, my company has arranged to exchange bearings. Our plan has worked to advantage to all throughout the country. We are notified of the size and type of bearing needed. We ship to this man a bearing in perfect condition ready to be mounted, and the charge for the service is no more than the cost of regrinding.

Although I have only touched on the high lights, I hope that a few results of our long experience in this end of the industry will not only prove instructive, but will result in more attention being paid and more care given to this vital part of not only the automobile pleasure car or motor truck, but of all machinery. This will bring about a decided saving of time and expense.

CORLISS STEEL COMPANY ORGANIZED.

The Corliss Steel Company has been organized in Racine, Wis., with capital of $10,000, as the preliminary step in the organization of a large tractor and engine business. The promoters are F. Lee Norton, for many years vice president and general manager of the J. I. Case Threshing Machine Company; Captain William Mitchell Lewis, former president of the Mitchell-Lewis Motor Company of Racine, and Herbert F. Johnson, also of Racine. The company is organized for the purpose of manufacturing engines, tractors, farm machinery, machine tools, and to make and deal in forged, stamped, pressed steel and metal products. The company, it is said, will begin business in the large plant of a defunct Wisconsin engine company at Corliss, Wis.

SPRING COMPANY INCREASES CAPITAL.

An additional $1,000,000 has been added to the capital of the Perfection Spring Company, Cleveland, O. It now stands at $2,500,000. There has been no change in the management or personnel of the company. Of the new capitalization, $1,000,000 will be common stock, to be issued at once. Some additional preferred is also to be issued. New directors elected are F. E. Prentiss, Chester C. Bolton and T. E. Borton. The stock is all being taken by stockholders and none is to be issued to the public at the present time.

JITNEYS PROFITABLE IN BALTIMORE.

Jitneys of the 'bus type have been found profitable in Baltimore. The-Pay-As-You-Enter-'Bus Company, after operating four light trucks with 'bus bodies for four months from the centre of the city to the residence district, has ordered two more 'buses and announces that it will shortly start the operation of a new line using eight more. The 'bus bodies are built by the Brill Company, maker of trolley cars, in Philadelphia, and the chassis are Buicks or Reos, with engine starting equipment, built for commercial service, for loads of 1½ or two tons.

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BATTERY CHARGING SETS.

Three Sizes of Outfits Designed for Use in Private or Public Garages.

The Robbins & Myers Company, Springfield, O., has developed a motor-generator set designed especially for charging automobile and motor boat batteries. This equipment may be operated from 110 and 220 volt direct current, or from 115 and 230 volt, 60 cycle alternating current. It is made in three sizes, of 80, 150 and 250 watts capacities. The 80 watt size is suitable for private garage service, but it is sometimes used in public garages where there is not usually need to charge more than one battery at a time. The 150 and 250 watt machines are for public garages.

The 80 and 150 watt generators are not heavy and are designed to be moved about easily. They are mounted with oak bases and either can be set on the running board of a car without marring the finish. The 250 watt size is usually installed in a permanent position in a garage.

The 80 watt eight volt outfits will charge one battery at a time, starting at a 10 ampere rate. The 150 watt 15 volt outfits will charge at same time either one 12 volt, or one six volt, or two six-volt batteries in series, starting at a 10 ampere rate. The 150 watt and the 250 watt 30 volt machines can be used to charge at the same time either four six volt batteries in series, or two 12 volt batteries in series, or one 12 volt and two six volt batteries in series, or one 24 volt battery. The 150 watt set is started to charge at a five ampere rate and the 250 watt set is started at a 10 ampere rate.

The Robbins & Myers Company's Motor Generator Set for Charging Small Batteries.

Ten feet of duplex cord with a detachable plug are regularly furnished for the motor side of the 80 and 150 watt sets and 10 feet of duplex cable with universal lead covered clips on the generating side. These leads are substantially anchored to the frame of the machine.

On the 250 watt sets the leads are brought out of the frame through bushed holes. The ends of these leads are fitted with brass connectors. There are four leads on the generator side, two to be used as line leads and two to be connected with the field rheostat. The smaller sizes have wick oilers and the larger ring rollers.

To use one of these sets the plug is screwed in the light socket and the switch turned on. When the generator has attained full speed the generator terminals are connected to either pole of the battery interchangeably. The smaller sets are designed to give a tapering charge to the battery and no rheostat is required. A rheostat is used in the generator field of the 250 watt sets. The motors of any of the sets will operate without injury on voltages 10 per cent. higher or lower than normal. No starting rheostat is required.

DRIGGS-SEABURY TO MAKE PARTS.

The Driggs-Seabury Ordnance Corporation of Sharon, Penn., which was taken over recently by interests formerly close to the Bethlehem Steel Company, is devoting a large part of its plant to the production of automobile parts, and after the war is over will continue large operations along that line. This part of the business will be permanent. The company is also installing equipment for the production of guns and ammunition and is already turning out some war material. These orders are supposed to be large. The company is understood to be producing trucks, as well as parts, and its permanent business after the war is over will be in building motor vehicles.

NEW BUILDING FOR GULF OIL.

Underwood Nazro, president of the Gulf Refining Company, has announced that the allied companies, of which he is head, including the Gulf Pipe Line Company and the Gulf Production Company, have decided on Houston, Tex., as the city in which they will concentrate forces which are now scattered in Port Arthur, Beaumont and a number of other places in Texas. A $600,000 office building is to be erected in Houston to house the offices of the companies.

TO MAKE TRUCKS IN IOWA.

The Iowa Motor Truck Company is to manufacture trucks at Ottumwa, Ia. The vehicles will be of 2000 and 3000 pounds capacity. Internal gear drive rear axles are to be used. Supplies for six months' manufacturing have been ordered. The new truck will at first be marketed exclusively in the middle west.

The Double Tread Tire Company of Denver is to be duplicated in Salt Lake City, Utah, where a similar corporation is being organized by the same promoters.

The trustee of the Brown Commercial Car Company of Peru, Ind., has asked for authority to sell the plant in the interests of the creditors.

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RURAL FREIGHTAGE AND PASSENGER TRANSPORTATION WITH MOTOR TRUCKS.

By GEORGE F. WHITSETT, the International Harvester Company of America.

AS ANYONE who lives or travels in the country knows, the city has no monopoly on motor trucks. The horse for transporting passengers and perishable merchandise has been tried by the all-American jury of rural service and declared to be too slow and too expensive to give the public full and complete satisfaction. Those of us who are connected with the large companies who sell motor trucks have an unusual opportunity to see how the idea of motor service has spread and, as we arrange the instances before us, we see that no section of the country, from West to South to East, or from the near city to the pure country, has failed to respond to the opportunities of greater economy and reliability offered by the motor vehicle.

Loading the Machine in the Field to Minimize Handling of the Crop Is an Economy When the Freight Is Small.

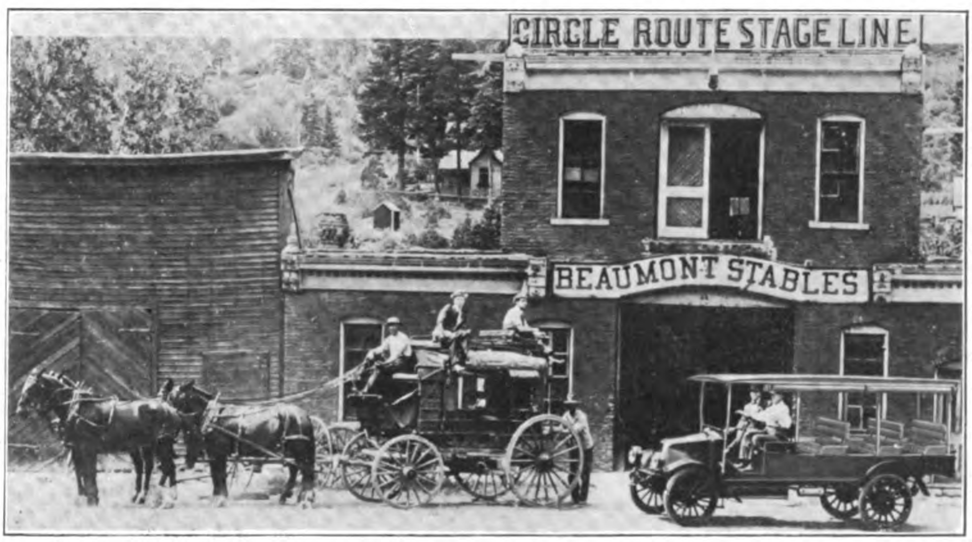
Whether it is for carrying the government's mail and parcel post and travellers over trails into regions inaccessible to railroads, or carrying human freight across mountains between railway lines, or whisking passengers between trains, or to hotels, or resorts, the motor truck is demonstrating its supremacy over horses.

Ninety-nine miles over a mountain trail is a long distance, but that is a road which is being travelled regularly by International motor trucks, which deliver mail in the mountains of northwestern California and southwestern Oregon. Altogether there are 12 International trucks used in mountain service in this region of high altitudes and slippery roads. The sales manager of the distributing concern recently took an unusual method of observing the trucks under the trying circumstances of mountain climbing. Without making himself known to the driver, he travelled over the stage route between Crescent City, Cal., and Grant's Pass, Ore.—the 99-mile trail. The account of the sales manager's trip reads like fiction.

"About five miles out of Grant's Pass we took the first grade, which was pretty steep, and one mile long. I asked the driver if he had any more like it and he informed me the next grade was five miles long and full of rocks. We had to make almost the entire distance on low gear, and you can imagine about how I felt when the driver told me the next grade was nine miles long—and I want to assure you he did not exaggerate any.

"The trail winds around and around the mountain and some of the curves are so short that it is necessary to back in order to make the turn. In some places it was not more than 12 or 18 inches from the roadway to the edges of the cliffs and there it was from 1000 to 1500 feet straight down.

"About 15 miles east of Crescent City we entered a redwood forest. The shade is so dense that the roads never dry and for 10 miles it is up grade from 20 to 25



The Stage Coach That Was Operated for 30 Years Between Ouray and Silverton and the Passenger Machine That Replaced It.

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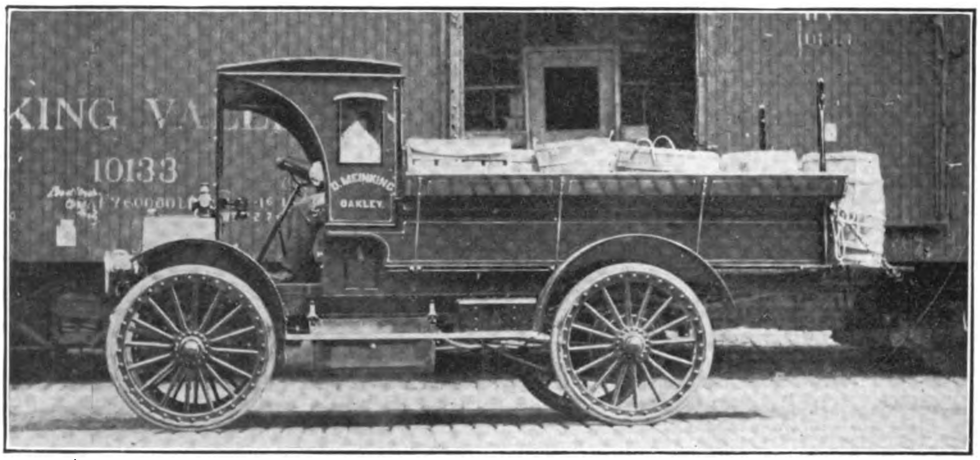


Time Is Saved by Loading Direct from the Railroad Car, This Reducing the Labor and the Time of Waiting.

per cent., and over a corduroy road. Through it all the motor truck carried a full capacity load. We started on the trail Monday morning and by 3 p. m. Wednesday we had completed the round trip."

Passenger Work Is Profitable.

The mood of the men who purchase these motor trucks is reflected in a letter which one of them wrote to the sales manager of the distributing company.

"The weather was very wet last month and the roads were muddy and rough, still we did not miss a trip, and every time we carried as much as the capacity laws would allow. We are thinking of selling off some of our horses and replacing them with these trucks, as the trucks are more economical and do the work more quickly."

A salesman who has sold trucks in that region, adds to the discussion as follows:

"I have sold five International motor trucks to a mail contractor and he made three of those trucks do the work of 52 horses during all last summer. Four of them are now doing the same work. The mail trucks have never failed to give full and complete service, and have come in regularly from six to eight hours earlier than the scheduled times."

Taking Place of Stage Coaches.

Motor trucks are destined before long to replace the picturesque old stage coaches which have become a part of the tradition of the American West. Only recently the famous old four-horse stage, which for the last 35 years had travelled the perilous trail between Ouray and Silverton, Col., was superceded by an International motor truck of 2000 pounds capacity.

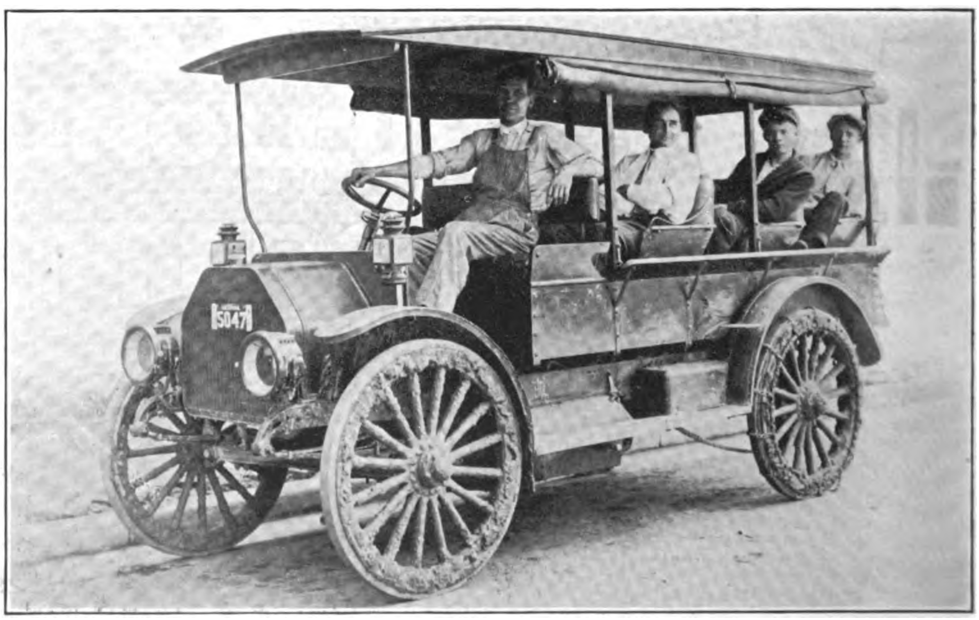
The Silverton-Ouray road was constructed by miners about 35 years ago. It is 25 miles long and skirts the tops of the mountains, being one of the highest stage lines on the continent. Recently it was broadened, improved and made safe for motor stages. The road is noted for its scenic attractions, passing through snowfields even during July and August, and is visited by hundreds of tourists during the summer season.

The old stage coach required an entire day to cover the 25 miles, but the new stage will make the trip in three hours.

At Knoxville, Tenn., one distributor alone has sold 20 motor trucks for passenger and freight service. These trucks cover routes in the hilly and mountainous sections of eastern Tennessee and southwestern Virginia. These users of motor trucks under trying conditions were recently asked to furnish information concerning operating costs and the returns which the trucks have paid on the investment. Every report was favorable and no one suggested the possibility of going back to horses.

"The roads are rough and muddy at times," writes one of the owners of a 1500-pound truck, "and it seems almost unbelievable that my truck would run so satisfactorily under such conditions."

Some of the statements of the Knoxville customers give us an inkling as to the cost of operation. "My average charge for carrying a passenger is $1," says one man who operates a motor truck stage line, "and the average cost for hauling the passenger is 13 cents, netting me a profit of 87 cents for each passenger hauled."



A Light Truck Operated as a Passenger Conveyance Between Poca and Charleston, W. Va., That Is Driven Over Very Rough and Muddy Roads.

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Trucks Making Delivery of Garden Products at the Store of a Dealer in a City, This Eliminating the Selling and Profits of the Middleman.

It seems that motor trucks have been brought to a point where reliability in a pinch pull is one of their most prominent characteristics. From an experience with motor trucks at El Paso, Tex., it seems that it is now a question of comparing motor trucks with automobiles rather than horses. The El Paso Jitney Company and the Oakland Auto Sales Company of El Paso, Tex., each contributed an International motor truck recently to help carry an outing party from El Paso to a point in the Organa mountains. These two trucks and two pleasure cars started on the journey. Here is part of what the El Paso Herald had to say later about what happened:

"If a recommendation were needed for the International motor truck, it could be had from any member of the Herald staff who happened to make the trip last Saturday and Sunday to Van Patten's Dripping Springs resort, above Las Cruces. Two of these trucks were used to convey the largest part of the crowd of Herald employees that attended the picnic, and both trucks made the trip to the resort up in the Organa mountains and back without a bobble. There was no hill too steep, no sand too deep for this truck—a car of 2000 pounds capacity—and loaded to carry every ounce of it. The other truck, of 1500 pounds capacity, did just about as well in the time it made, and carried a capacity load also.

"Two of the cars that started from El Paso—touring cars—failed to make the trip. Of two cars that were secured in Las Cruces, that started for the top, only one made the trip. Thus of four touring cars that started either from El Paso or Las Cruces for the resort, only one arrived. Of the two trucks, both arrived safely at the top, and neither had any trouble negotiating the steep hills or deep sand. There is some very deep sand above Las Cruces, also some very steep grades and rocky roads, but the motor trucks kept going all the time."

Hauling a Load of Produce from a Farm to a City Market, This Affording the Quickest Sales and the Largest Profits from Perishable Goods.

Apparently depreciation and repairs need not worry the owner of motor trucks as much as is sometimes supposed. In Whitehouse, N. J., is an International air cooled truck, which, since 1911, has been doing daily service as a hotel 'bus, and which is affectionately known in those parts as the "Village Stage" of Whitehouse. In addition to running 48 miles a day, meeting all trains, and carrying passengers between White House station and Whitehouse proper, the truck delivers passengers to the rural sections and does evening work of carrying loads of passengers to adjacent towns, lodges, clubs and theatres.

The Whitehouse stage, running almost day and night for the past four years, has made a total mileage of 113,000 miles, during which time it has been taken down and overhauled twice at a total expense of $178. The truck is in excellent running condition today and is serving its purpose as efficiently as ever. A correspondent writes that he has seen the Whitehouse stage called on to make trips into the country when the road conditions were so bad that spring moving with teams had been postponed.

Can the Farmer Use a Motor Truck?

With the development of power farming and power transportation for the stage, 'bus and mail lines, the questions come up automatically as to how soon the farmer will be using motor trucks, and what he will be using them for. These questions are already partly

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The Deep and Unbroken Snow Storms of the Country Are Not Obstacles to the Service of the Trucks, When Other Vehicles Can Hardly Be Operated.

adequate for the selling of grains and meats, and profits are sacrificed if there be delays.

Extremely important factors to obtain more speed and minimize the cost of farm operations are motor trucks, which are already a comparatively common sight on the country roads and highways in America. Farmers in almost every state of the Union are using motor trucks to get their produce to market rapidly and at a low expense.

The experience of these farmers is illustrated by the conversation of a man who lives 12 miles from Toledo, and who is engaged in supplying the people of that Ohio city with fresh vegetables.

"I used to deliver vegetables with horses," said the farmer. "In those days I had to get up at 3 o'clock in the morning to get my load packed on and reach the market at the right time. Now I have a motor truck and rise at 5.

"In addition to giving me two extra hours of good sleep, the motor truck is an economy in other ways. My horses used to be so tired with 12 miles of forced travel that I had to give them a chance to eat and recuperate for the return trip. Now my customers make their selections of cantaloupes, tomatoes, etc., and I deliver the produce at their places of business. This saves them trouble and makes me a preferred grower. I have no trouble in selling all the stuff I can grow. I can haul the load quicker and better than I could with horses, and my sales and profits are increased. I get home early in the day, and have more time to work on the farm."

Where Direct Saving Is Shown.

J. P. Ricket of Georgia, comments on the advantages of the motor truck which he was using in retailing his produce to Atlanta residents, as follows:

"I leave home at 6 a. m.," said Mr. Ricket. "with

answered by the experience of farmers who are now using trucks.

Surrounding every city of any size within a radius of 50 miles or more is a territory which is largely cultivated to produce the vegetables, berries. melons and fruits required to meet the needs of the population for immediate consumption. The cry for green farm products is growing louder, and is being heard farther and farther into the country every year. The doctors are urging the people on to eat green vegetables and fresh fruits with their meals. The farmer can no longer satisfy the ever increasing urban population by giving it grain for its bread and breakfast food, and pigs and cattle for its meat supply.

Something like 6,000,000 farmers, in addition to feeding their own families, must grow the food for about 70,000,000 people who have no part in producing their own supply. It is estimated that during the past decade there has been something like a 20 per cent. increase in the number of consumers, and only about a four per cent. increase in the number of producers. With these 70,000,000 separate appetites becoming constantly more diversified and insistent in their demands, this growing of the nation's food becomes an increasingly important occupation. The Twentieth Century farmer faces a man's job at the beginning of every working day in the year.

There have been several economic changes lately which have added to the care and responsibility of the farmer. Horse prices have been journeying skyward, and have been kept close company by the costs of hay, grain and stover. The scarcity and expensiveness of farm help has been steadily increasing. A further demand for speed has been added to the farmer's responsibilities, as the marketing of the perishable products of vine and tree cannot be done with the deliberate handlings which are

Returning to the Farm with a Freight of Empty Crates After the Delivery of a Load, an Example of Body Requirements for Rural Service.

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my milk, butter, eggs and vegetables. I cover seven miles of rough, hilly roads, and reach Atlanta in 35 minutes. I then make my retail deliveries and reach home by 11:30 a. m. and have the rest of the day to look after the farm.

"By the old way it took all day to make the trip. Customers were not so plentiful because delivery was slower and, besides, I could take only half the load in my milk wagon which I now carry.

"With the motor truck I have doubled my trade, as by the better and quicker service and the extra carrying capacity I can serve twice the number of customers."

A farmer in California contributes to the discussion by stating the usefulness of a truck in general farm delivery.

"We use our motor truck," says Mr. Chamblin, "in hauling our fruit and melons to Calistoga, St. Helena and Napa, in fact, we use it just as freely with everything pertaining to the farm.

"I find that the motor truck saves more than half the time formerly required for a team, and that, further, it delivers the produce of the farm in much better condition."

Profitable Even for Farm Work.

A statement which throws further light on the use of motor trucks for general farm delivery is made by W. M. Arnold, a farmer of Minnesota.

"I purchased a motor truck," says Mr. Arnold, "for hauling grain and for doing other work on the farm. I had been hauling barley with two teams a distance of 11 miles, making one trip a day with each team. I am now making six trips with my motor truck, which goes to show that I can haul as much grain in a day with my truck as I could with three teams."

Furthermore, Mr. Arnold answers a question which might arise in the minds of some as to the practicability of using a motor truck on the farm in winter.

"I have had no trouble in operating my truck in six inches of snow. I have also used it successfully in weather 36 degrees below zero. My experience leads me to believe that a motor truck is without question a practical thing for the farmer."

The opinion as expressed by the farmers who are already using motor trucks is unanimous in demanding a truck that can be used the year round in all sorts of roads and with plenty of power for climbing hills of any reasonable grade.

Given the right kind of a motor, there is nothing in the experience of farmer users to indicate that service for a motor truck on the farm is more destructive than in any other work, according to the manager of the Spring Brook farm in Michigan, who has used a machine continuously on his farm for three years. He has used this vehicle for general farm delivery. As a safe estimate, he stated, his truck had covered over 18,000 miles without any cost other than for spark plugs, batteries and fuel. Up to that time he had bought one set of new tires for the rear wheels.

Just Realizing Possibilities.

These are typical illustrations of the practical results experienced by American farmers who have utilized motor trucks for transportation from the farms to the markets, and while there is no reason to believe that the possibilities with these machines are fully exploited, there is in every instance justification of the judgment of the men who have a realization of the double earning that is practical to obtain. Not only is haulage itself materially reduced, but the better prices and the increase of patronage that is certain to follow superior service means greater profits.

The statements made demonstrate that trucks are not only desirable, but they are as necessary as farming machinery, for after all the success of any farm is absolutely dependent upon the products that can be sold and the prices that can be obtained for them. There is no question that the use of motor trucks means investment of capital, but the machines are extremely efficient when service is required, and the cost when not in use is practically nothing as compared with animal haulage equipment.

The farmers who own motor trucks cannot only select their markets, but they can supply them at times when there is the most lucrative demand for products, and long distance is not prohibitive. The farmers who once regarded the improvement of roads as unnecessarily burdensome cost, have, from the use of automobiles and trucks, found that these improved highways have not only increased the values of their property, but have reduced the expense of transportation to a surprising degree. There is keen realization of the possibilities from the use of scientific methods in cultivating crops, and that instead of being mere tillers of soil, primarily for the maintenance of homes and families, the American farmer of today is a progressive business man, who succeeds in ratio to his knowledge and judgment. The motor truck is the new method of transportation, and its possibilities are almost unlimited.

MOTOR TRUCK BUTCHER SHOP.

To supply rural and suburban residents who find it inconvenient to come to his shop in Hartford, Conn., Joseph McNamara of that city has had a special body designed for a large four-cylinder chassis, which includes a large shelved refrigerator in which a supply of meats can be carried. This is neatly lined with enamelled metal and has a very attractive appearance when the owner drives to a customer's door to weigh out the day's requirement of meat food.

The Detroit Commercial Car Company is to occupy a part of the plant of the Pontiac Chassis Company, Pontiac, Mich., which is making the chassis for its machines. The company expects to sell 5000 vehicles the first year. A selling organization is being formed.

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THE ECONOMIES OF SPECIAL TOOL EQUIPMENT.

By WARREN S. BELLOWS, the Walden Manufacturing Company.

EXPERIENCE is the greatest teacher, as all who have to do with motor vehicles will agree, and no matter how well versed one may be in theory, actual knowledge can only be gained from practise. The proportion of those who own and drive power wagons and pleasure cars that could apply practical mechanics gained from industrial training to the maintenance of their machines immediately upon acquiring them is exceedingly small—probably not more than one in 100, and yet without exception there is not a motorist who does not endeavor to economize by doing more or less adjusting and repairing, or by circumstances is compelled to undertake such work.

This well nigh universal purpose of saving is commendable, but those who essay either repairs or adjusting, from choice or necessity, learn very early that inexperience is a decided handicap, because they have no basis from which to begin. That is, they have found experts are forced to adopt what may be regarded as systematic elimination, and results are obtained frequently through experiment rather than by recognized standards of mechanical variations. This, of course, applies literally to engine operation, but it may also be applied generally to all machine functions.

A Typical Wrench Set That Is Designed to Meet Practically All Garage and Repair Shop Requirements.

Experience Teaches Value of Tools.

The average motorist has some knowledge of his own machine and more or less idea of what might obtain with other vehicles, and while he may be able to satisfy himself with the work that he can do, such satisfaction can only be realized after long experience and careful study of conditions. The vehicle owner who has mechanical training knows that he requires tools with which he can do repairing or adjusting, and that with those that are designed for special uses he can minimize his own labor, as well as being certain that the work will be well done. He knows that such tools will be serviceable for long periods of time and that they will be the most economical, although they may be an additional expense to him.

The motorist of experience knows that nothing will cause as great destruction as loosened nuts and bolts. So long as all the components are securely retained in their relation to each other there will be no more than normal wear, but this can only be insured against by constant inspection and attention. The more systematic the care the greater the degree of normal and efficient operation, and just in the ratio that there is neglect there will be abnormal wear and quick deterioration.

Economies Prompted Invention.

The experience of motorists with tools designed for other work has not been in any way satisfactory, and the realization that makeshifts were not to be trusted for careful and exact work caused inventive minds to devise special equipment that would lessen labor and insure against destruction of parts. While this need existed with a very large part of those who maintain their own vehicles, there was even greater demand for such tools from those doing repairing and conducting service stations, and manufacturers of tools, understanding the commercial value of such specialties, quickly sought those which appeared to be best adapted for the purposes and which would satisfy the requirements of the largest number.

The power vehicles of today are so constructed that they may be disassembled for repair or replacement, and the majority of manufacturers have adopted the use of standard bolts and nuts. This has in large measure simplified the problem of wrenches, for these are now made in sets which will serve every need and yet be few in number. By the use of sockets that are interchangeable with extension bars, any work can be done. To illustrate, the owner or mechanic who desires to equip his machine with ordinary wrenches would necessarily purchase those that would be adapted for every size of nut and for every location, which policy would entail considerable expense and necessitate carrying all the tools to be prepared for any eventuality.

Assortments That Meet Every Need.

Contrast this indiscriminate assortment with the compact series that may be obtained, each so designed that it can be used with ease and efficiency whenever wanted, and so constructed that by merely changing the sockets any nut can be fitted, no matter where it is located. Such sets are made to pack in small space, so they may be carried conveniently, and usually so

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arranged that any part may be found instantly. This refers particularly to those intended for carrying in the vehicle, but sets that include a large number, which can be used for practically any work, are assembled for service stations and repair shops.

In equipping a truck, car, shop or station, the owner will find that the acquisition of such a set of wrenches is one of the best investments that can be made. Not only is it sufficient for every purpose, and always available when wanted, but the saving of time and labor is a very large factor when the constant care necessary is considered. And if a shop or station is in mind, one may afford equally good service to a large number of machines with one set, which would be larger and suited for all kinds of work.

Wrenches of Distinctive Type.

The wrenches supplied are of varying designs and each make has its own individuality, although each set may be intended for the same uses. The constructions may differ considerably, however. The ratchet wrenches of the Walden Manufacturing Company are distinctive in that they are made with heavy wire handles, which were first made in 1906, and which have been specialized since that time. With the invention of demountable rims for truck and car wheels, brace socket wrenches were produced, and today the products include every type of wire handled socket wrenches. The wire handled wrench may appear to some to be a novelty, but it has been proven by 10 years of service to be a specially enduring construction. In ratchet wrenches the wire handle type is regarded as being the simplest form made, for it consists of but three pieces.

Wire handled socket wrenches with machine turned steel sockets are used for the same classes of work as are drop forged wrenches, and drop forgings are made with expensive dies that are serviceable for but one size of socket. The method of manufacturing wire handled wrenches makes it possible to produce other sizes or lengths of handles than the standard products with but a slight increase of the cost. The difference in price between the drop forged wrench and the wire handled wrench is entirely due to the difference in the cost of manufacture, and the claim is made with absolute knowledge from proof by service that the latter are in every way equal to the former. The wire handles can be adapted for any requirement.

There may be assumption that the production of bent wire wrenches is a simple matter, but manufacture has only been possible by designing and building special machinery to produce them, and the experimental and development work has extended over a long period. Only through constant observation and careful experiment has so efficient a class of tools been perfected. Walden wrenches represent characteristic industrial progression, for they are today recognized as being standard in quality, especially efficient and extremely low in cost. And, as might be assumed, large production had made all of this practical and possible.

TRUCK REPLACES TRAINS.

Chassis Driven on Roadbed Affords Profitable Service for Lumber Men.

On an abandoned mining railroad between Hartford and Monte Cristo, in northern Washington, a White 1½-ton truck equipped with steel railroad wheels, is being run to carry passengers and mail instead of the locomotive and car that formerly was operated at irregular intervals.

The road was built by eastern financiers in the early 90's and about $3,000,000 were spent on it before the mining district about Monte Cristo was found to be valueless. There is much standing timber along the line and a firm of Washington lumber men bought the road to get this timber to market.

Several hundred people live along the road and they require service to bring in supplies, mail and passengers. A very irregular service with the usual railroad equipment was given at first, but the volume of business was not sufficient to make it pay.

So the lumber men bought a White truck and had it fitted with the steel wheels and a 22-passenger body. It has extra long wheelbase, an extra high fourth speed, and the front wheels are fixed permanently in position so that the steering wheel need not be used.

This outfit requires but one man to operate it. He attends to the engine and collects the fares. The truck does 100 miles a day on from five to seven gallons of gasoline, which costs about 12 cents a gallon, and a very small amount of oil. As there are no tire bills the only other expense is for wages.

There is some very fine scenery along the route and since this service was begun many tourists have been attracted by the trip. The truck is to be operated continuously and in the summer two trucks instead of one will be used.

MOTION STUDY OF TRUCK DRIVING.

One of the reasons why A. N. Stanton, superintendent of delivery of a large Portland, Ore., department store, favors the electric over the gasoline truck, is that a motion study of the work of driving the two has shown that only five motions are required of the driver to start the electric to 12 for the gasoline car. When 300 stops are made in a day this involves 2100 extra motions for the driver of the gasoline car and is sure to add greatly to his fatigue, cutting down his efficiency for his other duties in the opinion of Mr. Stanton.

The Larrabee Deyo Motor Truck Company, Inc., has been formed at Binghamton, N. Y., to build motor trucks and manufacture accessories, with capital of $80,000. The incorporators are H. C. Larrabee, A C. Crossley and A. J. Parsons.

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THE ECONOMIES OF MOTOR TRUCK GOVERNORS.

By B. G. KRAMER, Pierce Speed Controller Company.

THE installation of governors in motor trucks is today considered as important as any other vital part in the vehicle, and it is pleasing to see that the advantages derived therefrom have caused both the user and designer to specify governors on all commercial vehicles. Governors are also used extensively on taxicabs and the fact is being advertised, which assures the riding public of safety against speeding.

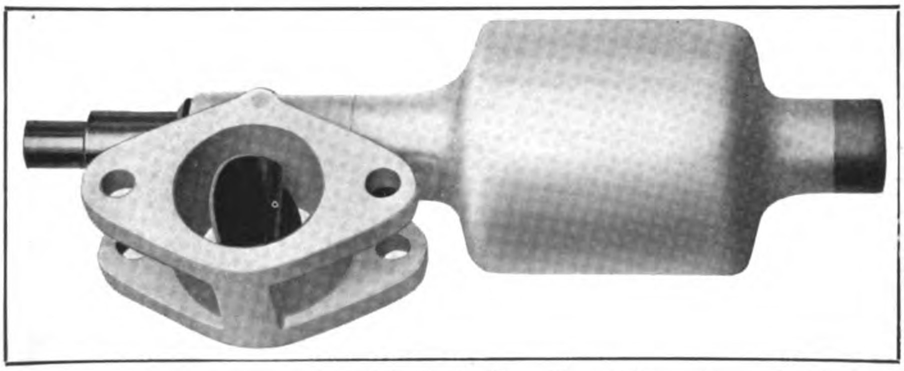

Fig. 1—The Edges of the Valve of Butterfly Type Travel Away from the Walls of the Throat and Obviate Friction or Sticking.

Coupled with the above facts the numerous accidents occurring in every city, which are the direct results of speeding, are forcing city officials and private owners to recognize the value of a speed limiting device installed in a motor vehicle of any sort or for any purpose.

Probably the greatest example and proof of the value of governors is the fact that our largest fire engine builders are equipping a great many of their engines with governors to limit the speed of the vehicles on the street. Speed in fire engine equipment is certainly an essential quality, but over-speeding here has also been proven very dangerous and harmful and the few seconds saved by over-speeding certainly do not over balance the liability of loss of both life and property.

While many interesting articles have been published showing the advantages of speed regulation, one very desirable feature, which the user can readily understand, has probably not been elaborated upon sufficiently, namely, the increased time that a vehicle so regulated maintains a constant speed.

All users are well aware of the fact that a change in speed, say, for example, of from 14 to 16 miles per hour, requires many times more power, plus additional strains, than is required to drive the vehicle either 14 or 16 miles per hour.

Where a vehicle is not governed these changes in speed occur constantly, as it is impossible for the driver, who invariably uses the accelerator, to keep his car running at a definite speed. Constant changes in speed forces the motor to deliver many more horse power units than is necessary for a given distance, and it is obvious also that since the speed changes require a greater number of horsepower units, the engine requires a greater quantity of gasoline for a given distance. When a vehicle is governor equipped and adjusted to limit the vehicle at a pre-determined speed it is only natural to assume that the driver will drive to his limit all the time possible, which necessitates his opening the throttle wide, allowing the governor to handle the engine, which keeps its speed constant and the gas supply at the minimum.

Of the governors in use today but one type seems to be popular and have the required efficiency, this being the centrifugal or fly ball type, which is used on more than 90 per cent. of the governed trucks manufactured in this country. For this preference there are many reasons. A governor, being a sensitive acting instrument, must be built so as to withstand the ever present strains such as back firing, vibration, etc., and as the centrifugal governor is power driven, it can be made heavy in all its parts, to stand the abuses it is subjected to.

Then, too, the governor must actuate the throttle in a positive way, and must have sufficient force to perform this function regardless of small particles of dirt which are liable to otherwise retard the movement of the throttle, or make it stick. The governor must be designed and built in such a manner that only the controlling throttle is located in the throat, as any mechanism placed in the manifold passage causes condensation of the gases and seriously effects the mixture of the carburetor.

Throttle Valve Serious Problem.

The question of a suitable throttle valve for governors has been a serious one, as these valves must be balanced, and at the same time be so designed that dirt and grit cannot make them stick seriously. The

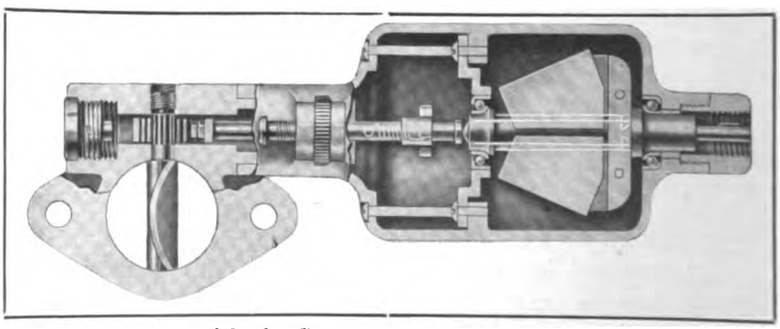

Fig. 2— Design with the Governor and Case Are Integral with the Valve Box, That Eliminates Complications in Transmitting the Governor Action.

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ordinary butterfly valve seems to be the best adapted for this service, as when mounted on an angle, as in Fig. 1, the edges of the butterfly travel away from the walls of the throat instead of rubbing, as in the case of a Corliss or piston throttle, which locks in case grit gets in between the two surfaces.

The butterfly valve is very simple and causes less condensation than other types of balanced valves, and I dare say that its use in practically all carburetors manufactured demonstrates its practical value. With the vacuum above the throttle the pressure of the atmosphere on the butterfly is considerable, being as high as eight to 12 pounds on the different sizes of engines used in motor vehicles.

This pressure is considerable on the butterfly shaft, but the friction can be cut down somewhat by mounting the shaft on hardened pivots. The friction of the gases going through the engine is much greater on the half of the butterfly which travels down toward the carburetor than on the side travelling up, but experiments have demonstrated that a hole drilled in the half that travels toward the carburetor will have a balancing effect, making the effort the same to open or close the throttle. Of course, the size of hole used in the butterfly varies with the size of valve.

Centrifugal Governing Mechanism.

By employing the old and well known principle of centrifugal force to governors, it is possible to enclose the required mechanism in a housing which is small enough for commercial purposes and at the same time obtain a pressure as high as 20 to 50 pounds from the revolving weights, which is more than sufficient to operate the throttle in a proper manner, forcing it in case dust or grit interferes in its action.

One trouble which has obtained in most governors until recently is the surging or hunting, as it is commonly called, which is caused, to a great extent, by incorrect mounting and the shape of revolving weights. Extensive experiments have demonstrated that for a given weight the pivot points must be located at a certain distance from the centre of gravity in the weight and a variation from this point is very liable to cause surging.

Drive and Mounting Cause of Failure.

Further, the methods of drive and control have been in the past another cause of surging and the governor's failure to maintain an absolute constant speed. When governors are mounted on the crank case, or some other point distant from the intake manifold, the action of the governor must be transmitted from it to the throttle in the intake manifold through rods, Bowden wires, etc., and must be encased, which is expensive as well as inefficient.

Friction at all joints and by rods and wire rubbing against the encasement seriously effects the action of the governor, and lost motion in all these joints also causes action to be irregular, as they must be as loose as possible to eliminate excessive friction.

Fig. 2 shows a design of a governor in which the case and governor are integral with the valve box and eliminates the troubles of transmitting the action of the governor. It can be seen that when the revolving weights are thrown out by centrifugal force that the small finger at the bottom of the weight acts directly upon the plunger, which has a rack on the valve box end.

This rack meshes with a small pinion on the throttle shaft, so that the plunger's movements are directly connected with the butterfly valve, making the valve respond instantly with the changes of the weight positions.

Integral Construction Best.

The integral construction of valve box and governor case not only eliminates the excessive friction and lost motion in the controlling rods, but is a much cheaper construction than the older methods of locating the governor on the cam or magneto shaft case, which is very inaccessible in case of trouble.

In a great many cases it is necessary to even remove the radiator in order to get at the governor for repairs or adjustments. Making a unit of the valve box and governor case also lessens the number of points to be sealed, which are such a temptation to speedy drivers. It prevents the driver doing as he may do with the gear case governors—drill a hole in the tube which encloses the control rods and drive in a wooden plug, which will hold the rod tight, so that the governor cannot function.

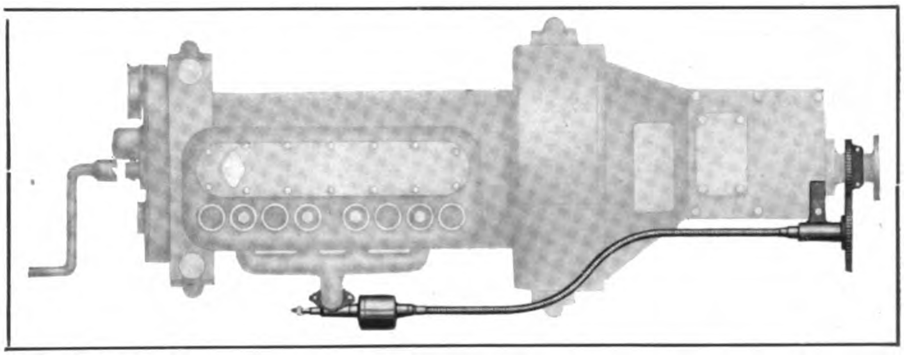

Fig. 3—The Governor Driven from the Transmission Gearset, This Allowing Full Power on the Lower Speed Ratios.

The centrifugal governor has a decided advantage over any other type of governor insofar as it can be connected to any moving parts of a vehicle. In a great many cases it is not possible to govern the speed of the engine directly on account of the gear ratios. When the ratio is such that the engine does not turn over fast at the vehicle's regulated speed and the engine is governed, it is not possible to get the required power of the engine on slow gear.

A Type Driven from Transmission Gearset.

However, in this case the governor can be driven from the transmission, as is shown in Fig. 3, which will give the driver full power on first and second speeds, or allow him to drive as fast on first and second speed as he can on high, which, of course, is impossi-

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ble when the engine speed is limited.

The speeds at which a centrifugal governor can regulate an engine are unlimited, which is not the case with a hydraulic or suction governor. With each driving speed of the centrifugal governor the regulation can be adjusted for speeds of plus or minus 200 revolutions per minute, which gives a variation of 400 revolutions. And if a greater variation is desired the driving speed of the governor can be so changed that if the engine is to be regulated as low as 200 revolutions per minute, the governor speed can be made the same as it is when the motor is run 1000 revolutions, making the same force for operating the throttle.

Properly designed governors are a great assistance also to the driver, as it is a well known fact that the throttle must be open at a psychological speed and time for the engine to handle a required load with the least effort. All carburetors cannot adapt themselves to instant changes and most drivers are not able to handle the throttle of a carburetor as a governor does. The governor opens the throttle only, when the engine requires it, or when the engine speed decreases and is not more than is necessary for a given load, as the position of the throttle depends upon the speed at which the engine is running.

MARTIN TRUCKS AND FIRE WAGONS.

The Martin Carriage Works, York, Penn., is producing a considerable number of motor trucks and special fire department apparatuses. The fire apparatus has been sold largely to volunteer companies in Pennsylvania and New Jersey. The chassis are equipped with Wisconsin engines and are assembled. The company is also starting work on 1000 light commercial wagons having load capacity of 1000 pounds. Thirty different designs of bodies for various purposes have been made for equipping the wagons.

WANTS CONSULAR SERVICE ENLARGED.

The Chamber of Commerce of the United States has taken a referendum of its members on the question of asking the government to strengthen its foreign trade service by establishing new consulates, raising the rank and pay of the various representatives, affording adequate clerical assistance and providing a sufficient inspection service. Figures are quoted to show that American consuls in different parts of the world are paid far less than those of other countries.

The Krebs Commercial Car Company of Clyde, O., has been reorganized under the name of the Clyde Car Company. It is capitalized at $25,000. J. W. Flickinger, Albert A. Wott and J. R. Baynes are interested.

The Romeo Foundry Company has purchased the plant of the Havers Motor Car Company at Port Huron, Mich.

WARD ELECTRIC MAKES NEW RECORD.

The Electric Vehicle Association of New York has officially recorded a new electric delivery wagon record made by a Ward special delivery wagon, which covered 98 miles on a single battery charge. It was operating under regular service conditions on the streets of New York, carrying a capacity load and making the average number of stops. The association's expert, John F. Delehant, was in charge of the car.

The route was through Manhattan and the Bronx and the 98 miles were covered in 16 hours and seven minutes, of which 12 hours and 2½ minutes was actual running time. The speed averaged 8.1 miles an hour and the number of stops was 35. The current consumed was the equivalent of 164.5 ampere-hours. This figures out at 1.68 ampere-hours per mile. The conditions were not favorable, as the run was made in a drizzling rain, which made the pavements slippery.

SPECIAL CONFECTIONERY BODIES.

With special bodies designed to carry a complete line of confectionery goods, several confectionery jobbers have greatly increased their business by selling direct at shop doors. The drivers of the trucks are salesmen, credit men, shipping clerks and delivery men, each selling and delivering goods directly from the truck. In one territory a single equipment has increased the business of one confectionery house 30 per cent., while the cost of covering the territory has been considerably reduced.

INTERFERENCE WITH WAR SHIPMENTS.

In and about New York City the systematic theft of fittings from and damage to cars and trucks consigned for Europe for use by the allied armies has been the source of careful police inquiry. Thirty trucks have been disabled in Weehawken, N. J., and shipped in a practically useless condition during the past two months. At least $80,000 worth of tires for commanding officers' cars, signal service, ambulance corps and other light cars have been stolen, as well as 30 or more magnetos, which are valued at $185 each.

The plant of the Atlas Drop Forge Company, Lansing, Mich., is being expanded to provide capacity for its increasing business. The additions will cost about $50,000 and the present force of 140 men will be doubled as soon as these have been completed.

The American Bronze Company, Berwyn, Penn., maker of Non-Gran bearing bronze, has arranged for an increase in its plant which will double the capacity. The addition will be finished in about six weeks.

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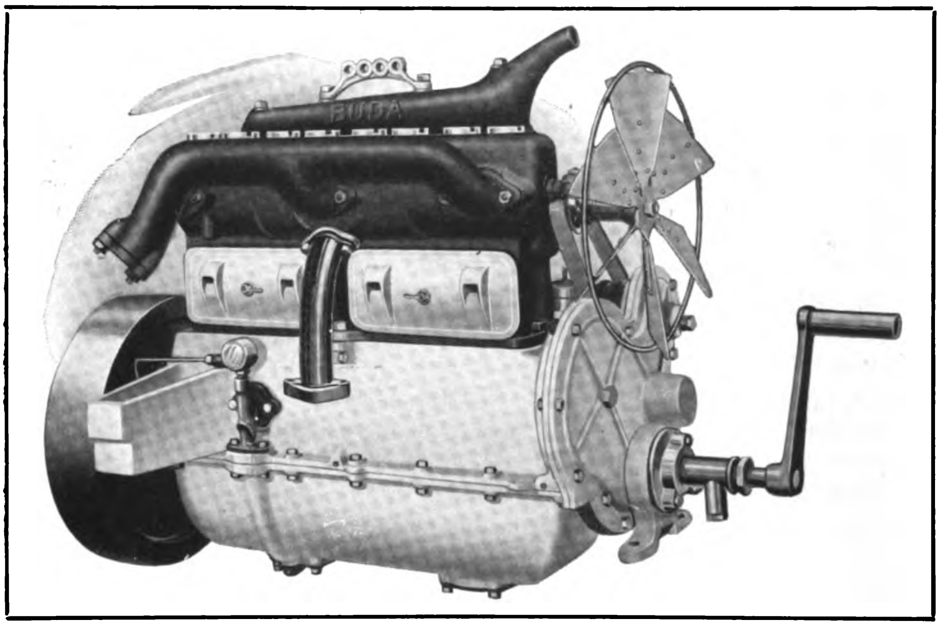
THE ESSENTIALS OF ENGINES FOR TRUCKS.

By L. M. VILES, the Buda Company.

THE essential points in a truck motor are of necessity in many cases quite different from those of a motor used in pleasure cars. At the same time, many so-called truck motors were originally designed and built for pleasure car purposes. This has resulted in some instances in the motors giving unsatisfactory results. However, during the past two or three years, owing to the rapid growth in the truck industry and the demand for dependable truck units, there has been a distinct improvement in the type and design of truck motors offered.



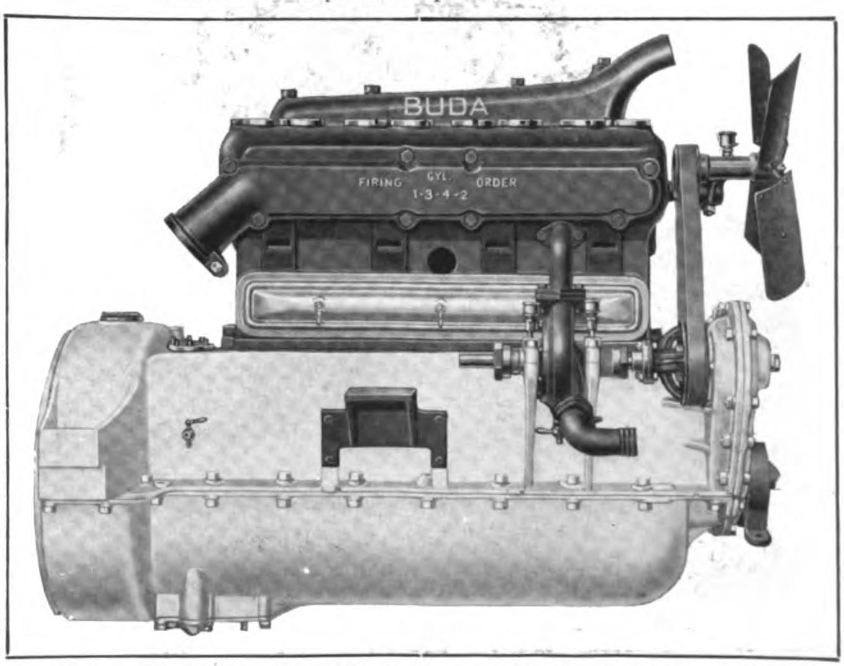
Model TM Buda Engine, Bore 4¼ Inches and Stroke 5½ Inches, with the Flywheel Not Enclosed, a Typical Truck Design of Medium Power.

The truck motor must be capable of standing up under continuous duty—24 hours a day, if necessary. It must be dependable at all times, with sufficient reserve strength in construction so that it will be capable of responding to an extraordinary condition if need be. Among other things, this means that the oiling system must work under all conditions. All bearings and reciprocating parts must be supplied with sufficient lubrication. Force feed lubrication by means of a geared oil pump forcing oil through a drilled crankshaft on to the main crank bearings is probably the most advanced type of oiling that has yet been devised, especially for the larger motors intended for trucks of four, five and six-ton capacity.

For the smaller sizes of motors used in the light and medium capacity trucks, the semi-force feed, either by geared or plunger pump, gives satisfactory results. Cylinder and piston lubrication is generally accomplished by means of the splash system, the connecting rods on their down stroke dipping into a trough or false pan and creating a distribution of oil throughout the crank case which supplies the necessary lubrication for the cylinder and piston walls. The timing gears are generally oiled direct from the crank case from an overflow from the front crank bearing. This method is simple and effective.

Ample Bearings Very Essential.

Ample bearings are most essential for the truck motor, and bearing pressures should not be allowed to run as high as in pleasure car motors. Above all, great care is necessary in scraping in the crank bearings. It is a temptation to the motor manufacturer to save on his bearing scraping, but it is poor economy, as a poorly scraped bearing will be very fruitful of bearing trouble. The best material obtainable is none too good. For crank and rod bearings (crank end) bronze shell babbitt lined bearings give excellent results. The bronze gives a stiff backing, which resists the tendency to "pound out," while the babbitt with a high percentage of tin gives a bearing surface which cannot be improved upon.



Model YU Buda Engine, Bore 4½ Inches and Stroke Six Inches, with Flywheel Housed, Designed for Heavy Duty.

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In cylinder design the en bloc type predominates and is generally considered as the best practise. This type of cylinder makes for a rigid motor, prevents the bearings from getting out of line and strengthens the crank case. The valve should be made as large as possible consistent with the size of the motor, and a fairly high lift can be used, particularly on the exhaust, which facilitates the scavenging of burned gases.

Water Jackets Must Be Large.

Exhaust passages should be ample and water jacketing should be used freely around all parts subjected to direct combustion. It has been found that the piston clearances of truck motors should be considerably more than those in pleasure car motors owing to the heavier work truck motors are called on to perform. All hardened steel parts, such as cams, push rods and piston pins should be held strictly to a standard of hardness, for a hardened and ground steel part that is below the standard of hardness will sooner or later commence to cut, which may be the cause of serious results.

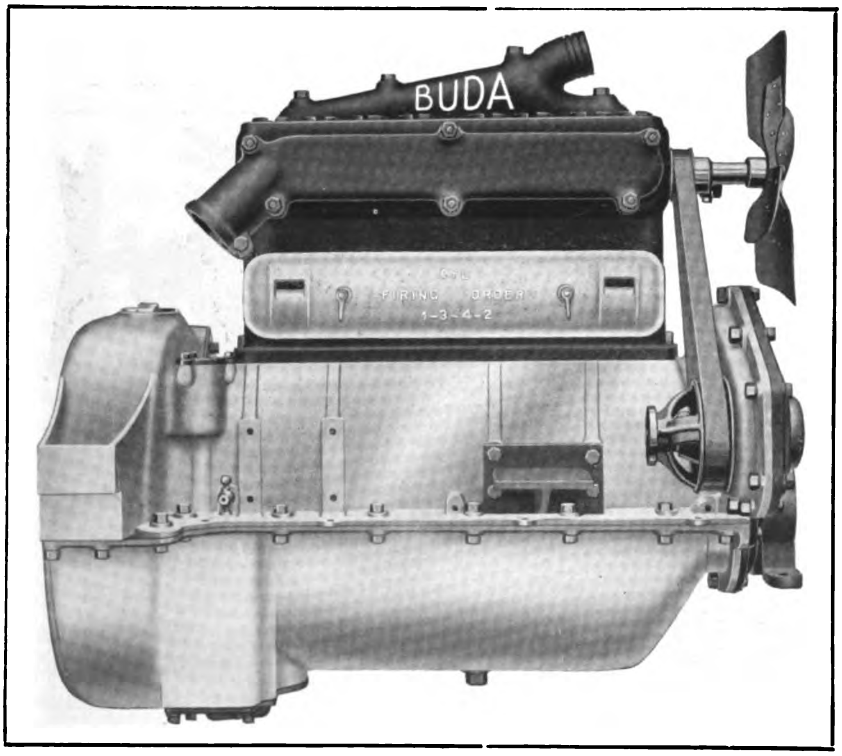
Above all the matter of workmanship is most vital, as proper design and good materials will count for naught if the machining of the parts is not done with the utmost accuracy and every piece carefully inspected and tested before being allowed in the assembly department. The proper balancing of the flywheel, crankshaft, pistons and rods is most necessary, for a motor out of balance will soon pound itself to pieces.

Tests Made with Great Care.

The final step in the manufacture of the motor, which is the testing, should be handled with the greatest care. It is essential that the motor should be "belted in" for several hours or run in by other means than under its own power. This gives all rotating and reciprocating parts a chance to adjust themselves before the motor is started under its own power. After this preliminary "running in" of the motor, it can be started under its own power.

It is advisable also to have the motor pull a load in the form of some type of dynamometer in order to approximate the work it will be called upon to perform in actual service. After the motor has been thoroughly run in, the oil pan should be dropped and the bearings, pistons, rings, etc., carefully examined. The slightest indication of improper functioning should be adjusted at this time. The motor is now ready for a final run and inspection.

The purchaser of a new truck should realize that he should not demand maximum capacity from his motor for the first few hundred miles. He should give the motor a chance to adjust itself to working conditions. A good motor is like any other good article, it will resent abuse and improper treatment, but will give excellent results as long as it receives good care and attention.



Model RU Buda Engine, Bore 3½ Inches and Stroke 5¼ Inches, Cooled by Thermo-Syphon Circulation, a Standard for Light Types of Vehicles.

CAST STEEL DIRECT FROM ORE.

The United States consul at Kingston, Ont., reports that the electric smelter at Bellville has perfected a process of producing steel direct from the ore which is in some respects similar to the Ford process of producing gray iron from ore.

A preheater utilizes the heat from the waste gasses generated by the smelter. This consists of two wrought iron pipes eight feet long and increasing regularly in diameter from 14 to 18 inches, so that the charge can slide easily down the heated portion. These pipes are enclosed in the preheater stack, which has fire brick lining and baffle plates arranged in such manner that the heated gasses circulate about the preheater pipes.

The furnace is charged from the upper floor into the preheater, the charge consisting of iron ore, limestone and charcoal crushed so that it will pass through a one-inch mesh.

The furnace is operated on a two-phase current, the transformers being connected by what is known as the Scott connection. The electrodes are three inches diameter, threaded so that they can pass down continuously and are used up entirely. The plant has been in operation two months and has proved that steel can be made in this manner directly from the ore with 7½ per cent. titanium. A quantity of high-carbon steel was made, the ingots being perfectly sound and free from blow holes. The company intends to erect shortly a three-ton furnace, with a view to making high-carbon tool steel and steel castings.

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UNITED STATES ARMY TESTS MOTORS.

The United States army is conducting a series of thorough tests at Fort Sill, Oklahoma, to determine the comparative efficiency of motor trucks and tractors in moving guns and ammunition as compared to the animal equipment that was formerly used.

Two trucks of different makes are being tested in hauling 4.6-inch guns and six-inch howitzer batteries. The seven-inch howitzer will eventually figure in the tests. The tests will determine the comparative efficiency of motors as compared to animals, and will be directed toward learning the utmost that can be done with motors rather than at trying them at very difficult work.

The first test will be moving ammunition and the load will be one full chest. Half the distance will be covered at the usual speed of animal drawn wagons and half at the speed most favorable to the motor truck. The second will be to pull guns and gun crews with ammunition for a short haul, such as is necessary when the guns are placed in action. The third will be for long hauls, such as are required for long marches. The tests will be made up hill and down hill with sharp turns in different directions, over fords and in other conditions such as are ordinarily found with animal drawn equipment.

DIXIE MAGNETO IN AEROPLANE FLIGHT.

In a contest for a prize of $5000, offered for the Curtiss aeroplane that would fly the greatest number of miles in a 10-hour day, a flying boat equipped with a 100 horsepower engine and a Dixie eight-cylinder magneto, was driven 480 miles in 10 laps of a course touching Hammondsport, and Pen Yan, over Keuka lake, New York. Only once during the day was operation of the engine interrupted except to take on fuel and supplies, and that was when dirty gasoline necessitated the cleaning of the carburetor.

The Bell Motor Car Company of York, Penn., is shipping a light delivery wagon of 1200 pounds capacity, equipped with open and closed bodies. It is mounted on the same chassis as the Bell passenger car and has an electric lighting and starting system. A Bosch magneto is used instead of distributor ignition. The price is $750.

Five years' use of five KisselKar trucks, during which the vehicles were driven 60,000 miles, proved so satisfactory to Alexander H. Revell & Co., of Chicago that it placed an order for four more of the same type trucks.

The Hurlbut Motor Truck Company of New York City has moved to a new plant at Third avenue and the Harlem river. More space is available and both water and rail shipments from the plant are possible.

MUCH ROAD WORK IN 1914.

According to the National Automobile Chamber of Commerce a quarter of a billion dollars was spent on roads in the United States in 1914. One-fifth of the work was done under the state aid system, the various state highway departments paying $24,220,000, and the counties and townships $25,193,000. State aid laws are in effect in 44 states. New Jersey having started the system in 1891 and Tennessee and Georgia adopting it in 1915.

Thirteen states spent $25,605,000 during the year in construction and maintenance without state aid. Repairs cost $12,500,000 and $35,500,000 was spent for new construction. There are now 247,490 miles of hard surfaced roads in the United States out of a total of 2,273,000 miles of public roads, or 10.9 per cent.

Last year 6805 miles of state roads and state aid roads were built, making the total of new roads built to Jan. 1 last 35,477. The great loss involved in using surfaces that are not suited to modern traffic is shown by the following figures for maintenance and new construction in a number of states:

	Maintenance	New Construction
Rhode Island	$146,800	$28,400
New Jersey	2,145,000	1,329,000
Pennsylvania	1,689,000	2,700,000
New York	8,628,000	12,856,000
Massachusetts	805,000	1,610,000
Connecticut	925,000	2,587,000
Total	$14,338,800	$21,110,400

URGE TRUCK DEALERS TO UNITE.

Mayor Blankenburg, at a recent meeting of the Philadelphia Motor Truck Association, urged the truck sellers and users to combine to influence the building of good roads in Pennsylvania and good pavements in Philadelphia and to insist that state money be carefully expended. E. B. Jackson of the Packard Company, president of the association, condemned the L shaped car rails used in Philadelphia and declared that the streets of Philadelphia and Baltimore were harder on trucks and caused more tire expense than those of any other cities in the country.

The Flinchbaugh Manufacturing Company, Greencastle, Penn., has sold its plant and business at private sale for $42,500 to the Landis Tool Company. The Flinchbaugh company made gasoline engines for tractors. The new owners will build Landis shock diffusers and other automobile specialties.

The Brockway Motor Truck Company, Cortland, N. Y., has purchased an acre of land near its present plant and is erecting a building 40 by 186 feet. A second building will be built the coming spring.

The Howe Rubber Company, which makes tire tubes at New Brunswick, N. J., is building a $70,000 factory.

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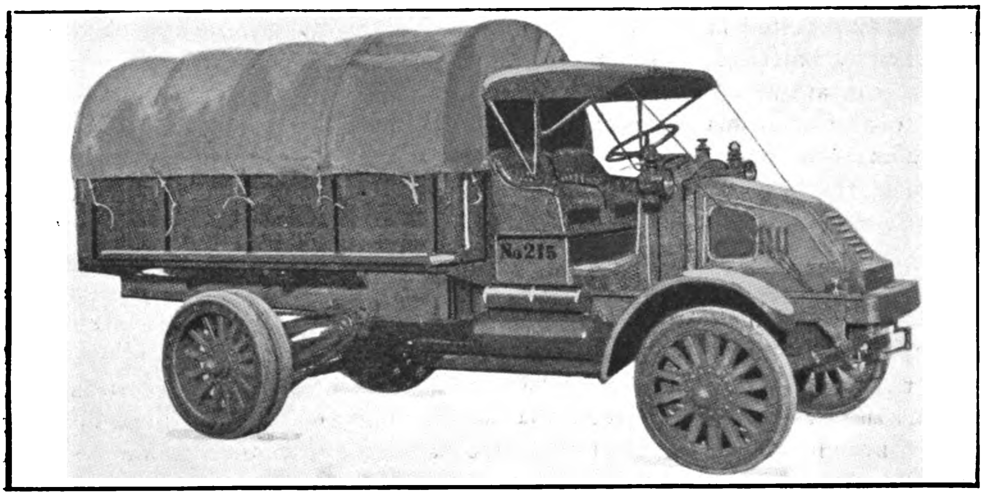
MOTOR TRANSPORTS IN THE EUROPEAN WAR.

AMONG the chief duties of the Canadian militia department when it was mustering and equipping the Canadian contingent for war service in Europe, was to provide motor transport to haul the equipment and necessary supplies for the commands.



Type of Body Equipment Supplied for American Truck Chassis for Use by the Canadian Contingent Serving in the European War.

These trucks, in the shape of bare chassis, were bought from dealers representing factories in the United States. The wood work on the bodies was done by Massey-Harris Company, Ltd., of Toronto, and the steel work and metal fittings was provided by the shops of the Russell Motor Car Company.

The standard bodies on the transport trucks have sides 40 inches high, with brown tarpaulin covers, supported on wooden hoops, which may be raised or lowered to fit them to the height of the load. An extra tool box is built on the right side of the truck and two tanks are carried on the right running board, to store gasoline and oil in excess of the capacity of the regular fuel and lubricant containers.

On the left side of the truck a box is provided for holding cans of grease, carbide and oil and a fire extinguisher. Other special equipment consists of a canvas bucket, axe, shovel, crow bar, block tackle and steel tow rope with chains and mud hooks for the rear wheels.

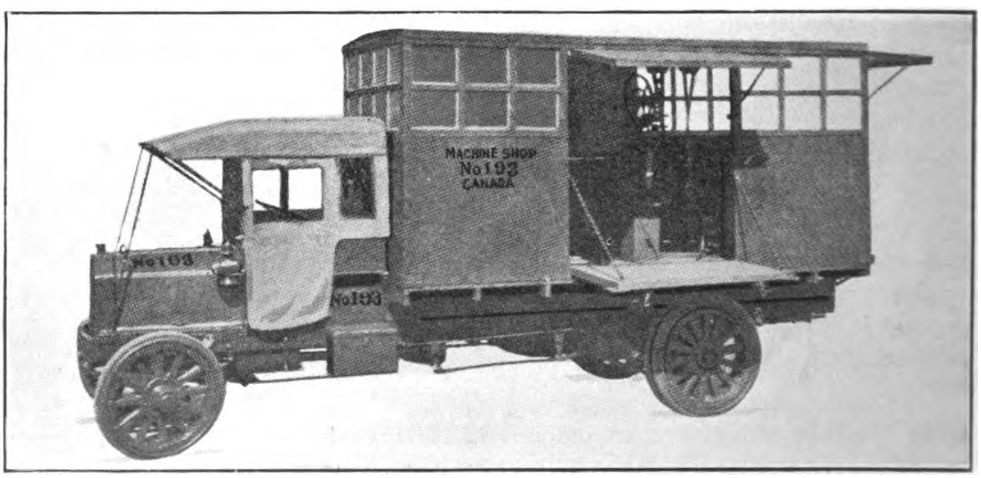
Several motor machine shops were also supplied to keep all the trucks in condition. These were mounted on Peerless chassis. The bodies are made with steel frames and sides and are equipped with fireproof glass windows. There is one door in each side and one the full width of the body at the rear. Each door is divided in the middle, so that the lower half drops down level with the door, while the upper half raises to the height of the roof.

The equipment of the shop consists of an engine lathe, geared drill press, double head emery grinder, band saw, blacksmith's forge and anvil. All machines are complete with tools and stock is carried in racks on the sides of the body.

There is in addition a work bench, vise jacks and a full equipment of hand tools, including pipe fitting and tin working outfits. The jacks provided are large enough to lift a considerable section of railroad line. Steel cupboards and drawers are provided for storing small parts and stores. At night the body is brightly lighted by electric lights, which are supplied with current from a small dynamo and storage battery. All the machinery is belt driven from a line shaft which is run from the transmission gear set.

BRITISH SLOW WITH WAR CARS.

The great advantage maintained by Germany in preparation for the use of motor transport before the war is beginning to be realized in England. From the first the plans and preparations of the Germans were very complete. The English war office was finally forced to give heed to them, but it began the work too late and moved too slowly to accomplish much. Very few government subsidy trucks were in existence at the beginning of the war and vehicles of all shapes and sizes had to be commandeered. This diversity of ma-



Peerless Chassis Fitted as a Transport Repair Shop of a Type Taken by the Canadian Commands in the European War Expedition.

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chines cost the nation many millions of dollars.

In Germany by the end of 1914 there were 1000 vehicles subsidized by the war office. All the transport requirements of 50 army corps could be supplied with them. Each train consisted of a truck and trailer having capacity for carrying six tons at about eight miles an hour over good roads. The Reichstag, through the efforts of the Kaiser, supplied $750,000 for this purpose. In 1913 there were 14 German manufacturers turning out trucks suitable for the army.

The German great artillery, which caused such surprise by blowing down down the strongest forts at the beginning of the war, was motor drawn. The Germans had known for long that such guns could not be transported by rail because their weight and bulk were such they could not be taken through tunnels and under bridges. They had prepared great motor vehicles, too large for any peace use, for hauling these cannon, and they were ready when war was declared.

PARIS MOTOR 'BUSES GREAT WORK.

No lot of motor cars used by the French during the European war has been given more severe service than the 1000 internal gear drive 'buses that were used on Paris streets and which were commandeered at the opening of the war. Mr. De Freminville, chief engineer of Panhard & Levassor of Paris, has recently sent an account of the work of these machines to the Internal Gear Drive Association of Detroit.

At the first call to arms the 'buses were commandeered and were used to take soldiers to the field, running night and day. They were then used to haul cannon, ammunition and food supplies to the most advanced positions. Some were used for carrying meat and they have hauled 30,000 tons a month since the war began. When they were used as 'buses the trucks did 34,000 miles a year. A driving pinion lasted on an average for a year and a crown gear for three years.

The internal gear axles now being made in America are believed to be better and to be made of more durable material than those that established this extraordinary record in France. As soon as one of these 'buses reaches a condition where a general overhauling is required, the army sells it at auction to a private bidder and a new chassis of the same sort is put into military work. In this way the civilians are supplied, the army kept up to best efficiency and the purchase of foreign trucks is made unnecessary.

MOTOR BATH ROOM FOR WAR.

The St. John Ambulance Association of London has recently had built and delivered to the British army a motor car fitted out to give the soldiers, especially the wounded, comfortable baths. Large canvases for the purpose of forming tent bath rooms are rolled up under the shelves on each side of the body, and tent poles and stakes are carried on the roof.

In the car are two circulating boilers, which supply hot water at the rate of two gallons a minute to taps from which water is taken by means of a hose pipe. The boilers are heated by kerosene vapor supplied under pressure and the kerosene is stored in a 50-gallon tank, which can be refilled by means of a hand pump and hose. Inside the car are store cupboards and shelves with a large fumigating cupboard, capable of holding 20 suits of clothes. The latter are cleaned and disinfected by vapor rising from a tank containing water and chemicals. The bath room can be carried on any 20 or 30-horsepower chassis and not a very long wheelbase is required.

DR. CARREL'S TRAVELLING HOSPITAL.

Dr. Alexis Carrel of the Rockfeller Institute for medical research in New York, who has been in charge of a 50-bed hospital at Compeigne, France, is to devote a part of his time in the future to a travelling hospital composed of five automobile trucks. Two of these will carry a portable operating room, another a sterilizing plant, a fourth an electrical generating plant and the fifth an X-ray room. The hospital will be thoroughly

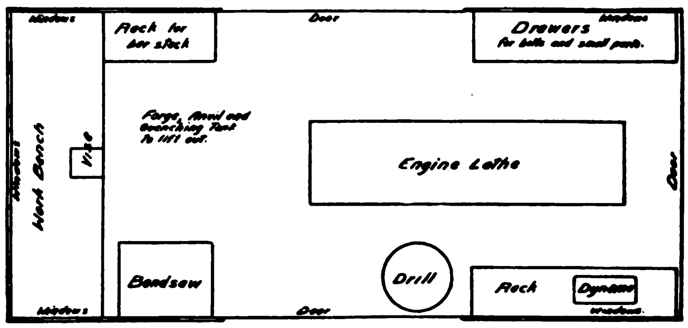

Diagram Showing the Interior Arrangement of the Canadian Motor Truck Field Repair Shops.

tried out at various points along the front. Dr. Carrel will continue to supervise the Compeigne hospital and a further extension of his activities in another direction is likely to be announced soon.

ACME TRUCK QUICKLY PREPARED.

Quick work was done in designing and preparing for the market the Acme truck which is to be produced by the Cadillac Auto Truck Company of Cadillac, Mich. The design of the two-ton and ¾-ton trucks which the company is to make have already been completed and dealers are being secured.

The two-ton truck is ready for the market. It will sell for $2000. The celerity with which the design was completed was made possible by the fact that many standard parts are used in the truck.

These include a Continental engine, Rayfield carburetor, Long truck type radiator, Pierce governor, Warner clutch and gear set, Smith pressed steel heat treated frame, Detroit springs, Gemmer steering gear, Timken front axle and Timken-David Brown full floating rear axle.

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CUBAN BUSINESS PROSPERS.

Federal Motor Truck Company's Managers Believe Its Prospects Are Excellent.

Great prosperity and decided progressiveness, which is developing the island very fast, were the conditions found in Cuba by M. L. Pulcher, vice president and general manager of the Federal Motor Truck Company, who has just returned from a sojourn of three months on the island.

He found business there to be better than at any time in the history of the republic. The reasons for it are a big sugar crop, which is bringing high prices, and a large tobacco crop. There has been an enormous increase of exports to South America, because the European nations have not been able to take care of the business that had been transacted there.

The motor truck and the automobile have been big factors in the recent development of the island. Two years ago cars and trucks were a rarity and mules and oxen were used almost exclusively. But now Havana has as many motor trucks as the average American city.

Motor taxi lines are flourishing and one can go from one end of the city to the other for 20 cents. Gasoline of the best quality sells at 50 cents a gallon and a poorer quality at 35 cents. Even with this high price for fuel the motor vehicle has proved a great economy in Cuba.

As an example of the progressiveness of Havana business men, Mr. Pulcher reports seeing a cigarette machine costing $5000 which had a producing capacity of 300,000 cigarettes a day. There is a strong good roads movement in the island. In Havana all the streets are fine except in the older parts of the city, where they are very narrow, the sidewalks being scarcely wide enough for two people to pass. In the newer parts of the city the streets are as wide and handsome as in the best cities in the United States. Country roads are being built into excellent macadam highways similar to those of Massachusetts. The natural roads are quite impassable for automobiles, but the new highways are making touring popular.

Mea MAGNETOS

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PUBLISHED MONTHLY AT PAWTUCKET, R. I.

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WM. H. BLACK	Pawtucket, R. I.
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NONE.

(Signed) WM. H. BLACK, Member of Firm.

Sworn to and subscribed before me this 7th day of October, 1915.

(Signed) MICHAEL F. COSTELLO, Notary Public.
(Seal) (My commission expires June 30, 1917.)

TO FINANCE TIME SALES.

The Acceptance Corporation of 55 Liberty street, New York, has organized a department which will make a business of taking notes offered by truck purchasers who pay only part of the price in cash and desire the rest on time.

The company has been in business since 1909 buying up the slow assets of corporations and thereby financing contractors in the handling of large jobs which otherwise they would be unable to undertake.

Among the men on the board of directors of the company are R. M. Owen, Roy A. Rainey, Robert H. Montgomery, Henry Bennet Leary, John Farson, Richard H. Swartout, E. D. Bird and David B. Mills.

This service is expected to make it possible for truck dealers to extend their business very much more rapidly than before by opening a big field for time sales that could not previously be touched. The dealer can pay the manufacturer cash for the truck, do all his business on a cash basis, avoid tying up his capital in notes and get rid of the bother of collecting such notes when they become due.

MANY BALL BEARINGS USED.

An idea of the large consumption of ball and roller bearings in the United States is given by George T. Gwilliam, president of a distributing company in New York. He says that the United States consumes steel balls at the rate of 15,000,000 a day and complete bearings at the rate of 15,000 a day. These bearings are used in automobiles, bicycles, motorcycles, machinery, machine tools and a thousand other lines of industrial endeavor.

When the Underwood committee was considering the tariff on anti-friction bearings, it was shown that

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Spec. 1108 Ad. 74

Some International Dealer Helps

It is the policy of this Company to render every possible assistance to dealers in developing and following up prospects. This dealer service takes many forms, but it all has one object—to help our agents make sales. The folders here reproduced tell how

MACK TRUCKS

have solved delivery problems for contractors, coal dealers, expressmen, and many others. This literature goes to *your prospects*.

We have some territories still open. Send for details and copies of our Dealer Helps.

INTERNATIONAL MOTOR COMPANY

64th Street and West End Avenue New York

the gross sales amounted to $15,000,000 annually. At that time 29 concerns, of which 12 were importers of foreign bearings, were competing for the business. Roller bearings are all made in this country, but ball bearings came from Germany, Sweden, Italy, France, Switzerland and England. The war has shut off all imports except those of Swedish bearings, which have increased in quantity. The largest producer in America is the New Departure Manufacturing Company of Bristol, Conn.

ALLIS-CHALMERS HAS BIG ORDERS.

No definite figures have yet been given out by the officers of the Allis-Chalmers Company, Milwaukee, Wis., regarding the total amount of business on order Nov. 1, but it was estimated at close to $8,500,000. The last previous announcement showed $8,000,000 of unfilled orders. The net profits for the quarter ending in September amounted to $333,008, and sales reached a value of $3,062,371.

In the June quarter the profits were $194,813 and sales $2,816,181. Between 5200 and 5300 men are now employed, the force having been increased by 360 during the past month. The plant is operating at 80 per cent. of capacity. There have been no exceptionally large orders for any one product, but the business has been well distributed.

FRENCH COMMISSION SEEKS MACHINERY.

A commission from the French government is in the United States making a thorough study, that will continue several months, of various branches of American manufacture and of American machine tools.

After the war French industries will be handicapped by lack of men and horses and the idea is to make use to the fullest possible extent of labor saving tools. Agriculture is to be largely reorganized by the use of power machinery and such business as the textile trade, of which the chief centres have been destroyed by the war, will be rebuilt and the most effective tools put into operation.

It is the aim to buy many of these tools in the United States, where they have been developed to a greater extent than in other countries. Efforts will also be made to get an American market for the French productions that are made with American tools and preferential treatment for French goods may be asked.

TRUCK DEMONSTRATION IN PARAGUAY.

The first motor truck ever seen in the republic of Paraguay was recently taken there by an American demonstrator, who made the trip at the expense of the Paraguayan government. Many demonstrations of the truck were made to show its utility for freight

transport over the bad roads of the country. The President of the republic and the ministers of war, interior and public works rode on it over a very rough road and were favorably impressed by its work. Moving pictures were made of the demonstration and were shown in the most popular picture theatre in the capital. It is probable that several trucks will be purchased and a company may be formed to truck freight to parts of the country removed from the river and the railroads, where the only means of freight transport in the past has been bullock carts.

FREIGHT HOUSE PROVISION FOR TRUCKS.

There are evidences that the more progressive railroads may be prevailed upon as soon as demand by business men becomes a little stronger, to install special provisions at freight stations for the quick handling of truck loads.

Such provision is unquestionably necessary to secure the greatest motor vehicle efficiency. As trucks increase in number and business men better understand the requirements for economical operation pressure on the railroads to co-operate in this improvement of efficiency is sure to follow.

A start has already been made at the instances of concerns that receive large shipments of freight and who have demanded that they at their own expense be allowed to install satisfactory facilities at the freight houses for the handling of their goods.

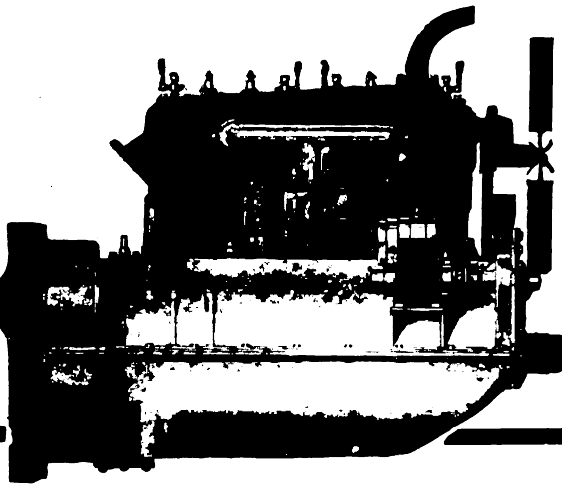
Special cranes have been installed by such an arrangement at the Broad street station in Philadelphia. These are adapted to lifting a removable body from a truck chassis so that it can be loaded while the truck is away, and for replacing the loaded body. The Pennsylvania railroad has permitted the installation of like equipment under similar arrangements at Baltimore.

BATTERY CHARGING EQUIPMENT.

A booklet of 16 pages, describing the battery charging equipment produced by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just been issued. The types include the well known Universal Unit system for large fleets and public garages, as well as panels and rheostats for individual vehicle charging, and rheostats for charging batteries used on starting, lighting and ignition systems of gasoline cars.

The Universal Unit type consists of individual units assembled in large frames. Each section is a self-contained unit, consisting of a slate front 24 inches wide by 10 inches high, which carries a rheostat contact and a sliding rheostat head, a low current cut out at the left, an instrument switch at the right, a pilot lamp, fuses and a grid resistance mounted on the back.

Some of the advantages claimed for this system are simplicity and accessibility, ease of operation, ease with which new sections can be added and automatic



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Cylinders interchangeable.

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CRANKSHAFT—Four bearing, chrome nickel steel, 2" diameter.
VALVES—Rich Tungsten steel.
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BEARINGS—Bronze Fahrig, metal lined.
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3 Point Suspension.

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The leading motor manufacturers and builders of trucks endorse the Pierce products.

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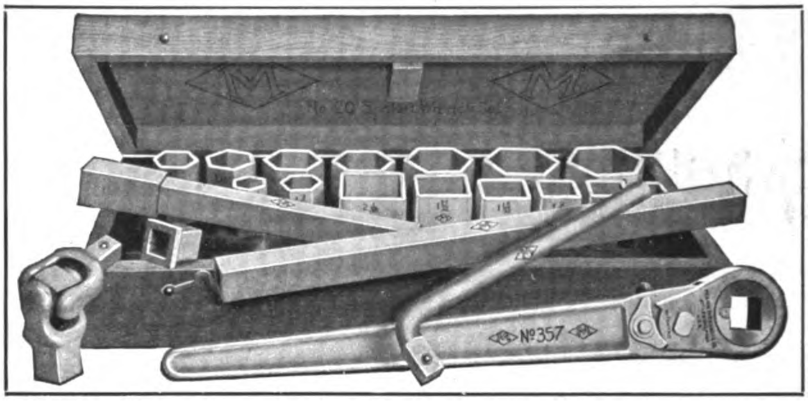

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protection without complication. No wiring is necessary except that to the battery lead. It is compact and a large number of sections may be placed in a small space.

WATER RUINS ROADS IN WINTER.

Water wears and damages roads in the winter, according to the experts of the Department of Agriculture and not the cold or the thaw that comes in the spring. When the water in the road turns to ice it expands, the road surface heaves and breaks to pieces. When the thaw comes it is easily rutted. If this happens two or three times in a winter a road may be ruined.

The remedy is to keep the water off the roads. The time to prevent water getting into the road is in the fall, before the rains begin. If the road goes into the winter thoroughly dry, with the surface and drainage in good condition, the chances are extremely favorable that it will come out in good condition the following spring.

The ditches and drains should be kept open. All accumulations of weeds and grass obstruct drainage and retain moisture. When the fall rains begin a dirt road should be dragged frequently to prevent the formation of ruts and the collection of water. Ravelled places should be filled in and consolidated.

During the winter the cross drains and side ditches should be frequently cleared. If a thaw is so pronounced that the roadway is softened, the drag should be used. Often one round trip of the drag with the hitch reversed will entirely free the road of snow or slush.

ANNUAL CONVENTION OF S. M. E.

The annual convention of the Society of Mechanical Engineers will be held in New York Dec. 7 to 10. Dr. John Brashear, president of the society, will make the opening address and a business meeting will be held on Dec. 8, during which the reports of standing committees and the power and test committee will be received.

Professional papers will be presented by Arthur H. Lyman, Hollis Godfrey, David Lindquist, J. S. Barstow, C. F. Hirschfield and A. L. Menzin. Papers on steam power will be read by F. W. Dean, Robert Cramer and Allen H. Babcock. Railroads will be the subject of the afternoon session and papers will be read by Anatole Mallet and Roy V. Wright. Other subjects will be treated by Albert G. Duncan and L. C. Brooks. The convention will meet Dec. 9 in sections. Power plants will be discussed by L. B. McMillan, George H. Gibson, Paul A. Bancel and Mark Replogle. There will be miscellaneous papers by Ernest O. Hickstein, James E. Boyd, Charles T. Main and Lewis Illmer.

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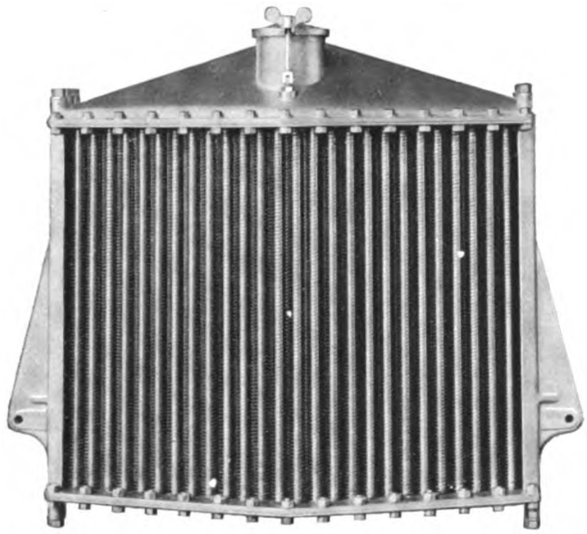

Seamless Helical Tube cooling sections are guaranteed for the life of the motor on which they are installed. Helical Tube construction passes the most critical requirements of foreign and domestic engineers.

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Made in three models—"C" One Ton Chain Drive; "A" One and one-half to Two Ton Chain Drive; and "D" One and one-half to Two Ton Worm Drive. Covers every truck requirement. Our Dealer's proposition cannot be equalled. Write for it.

BESSEMER MOTOR TRUCK CO., Grove City, Penna.

Model "C"—$1250
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Model "D"—$2300

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Steering and Differential
GEARS
are standard on good Motor Truck Construction

Write for Catalog

ROSS GEAR & TOOL CO.
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TRUCKS SUCCESSFUL AT PLATTSBURG.

Analysis of the service of motor trucks at the Plattsburg encampment, where for the first time they were used for the entire transport of a military column in the United States, shows that they were unexpectedly successful.

After two days' experience they completely displaced mules, being driven into places thought to be inaccessible for trucks, striking camp later and establishing new ones earlier than had ever been done before, besides doing a wider variety of service than had been possible by former methods.

In addition the special adaptations, such as searchlight work, hauling artillery at high speeds, carrying engineering material and quick transportation of bodies of troops, showed exceptional usefulness.

There was practically no necessity for repairs despite the hard usage. Heavy trucks proved their value for some works, but the greatest usefulness was found with the two-ton sizes. One such truck can displace five four-mule teams in ordinary military use.

FRENCH ARMY SELLS TRUCKS.

That French manufacturers of motor trucks can now meet all the demands of the army for vehicles is shown by the fact that an auction sale was held recently in Paris, at which 740 internal gear drive omnibus chassis formerly used in Paris and commandeered when the war broke out, were sold to private users.

These have been replaced in the French army service by new chassis of the same type. By this method the French keep the army equipment up to the highest point of efficiency, while at the same time they supply private owners who badly need trucks, so that there is no opening left for the purchase of foreign trucks. If some foreign chassis were used buyers might continue to purchase them after the war because of their good qualities or in the interest of standardization.

The foreign trucks used by the French army are not sold even as second-hand trucks, but will be used until they are worn out and then junked. In this way the French market will be kept entirely for the French makers.

MICHIGAN SERVICE MEN ORGANIZE.

With the aid of the National Automobile Chamber of Commerce, given through its general manager, Alfred Reeves, the men of the service departments of motor car manufacturers have recently completed an organization covering Michigan, northern Ohio and western Ontario.

The purposes of the association are to promote personal acquaintance among the representatives of the service and repair parts departments, to consider the best methods of conducting the business of making repairs and giving service, and to facilitate co-opera-

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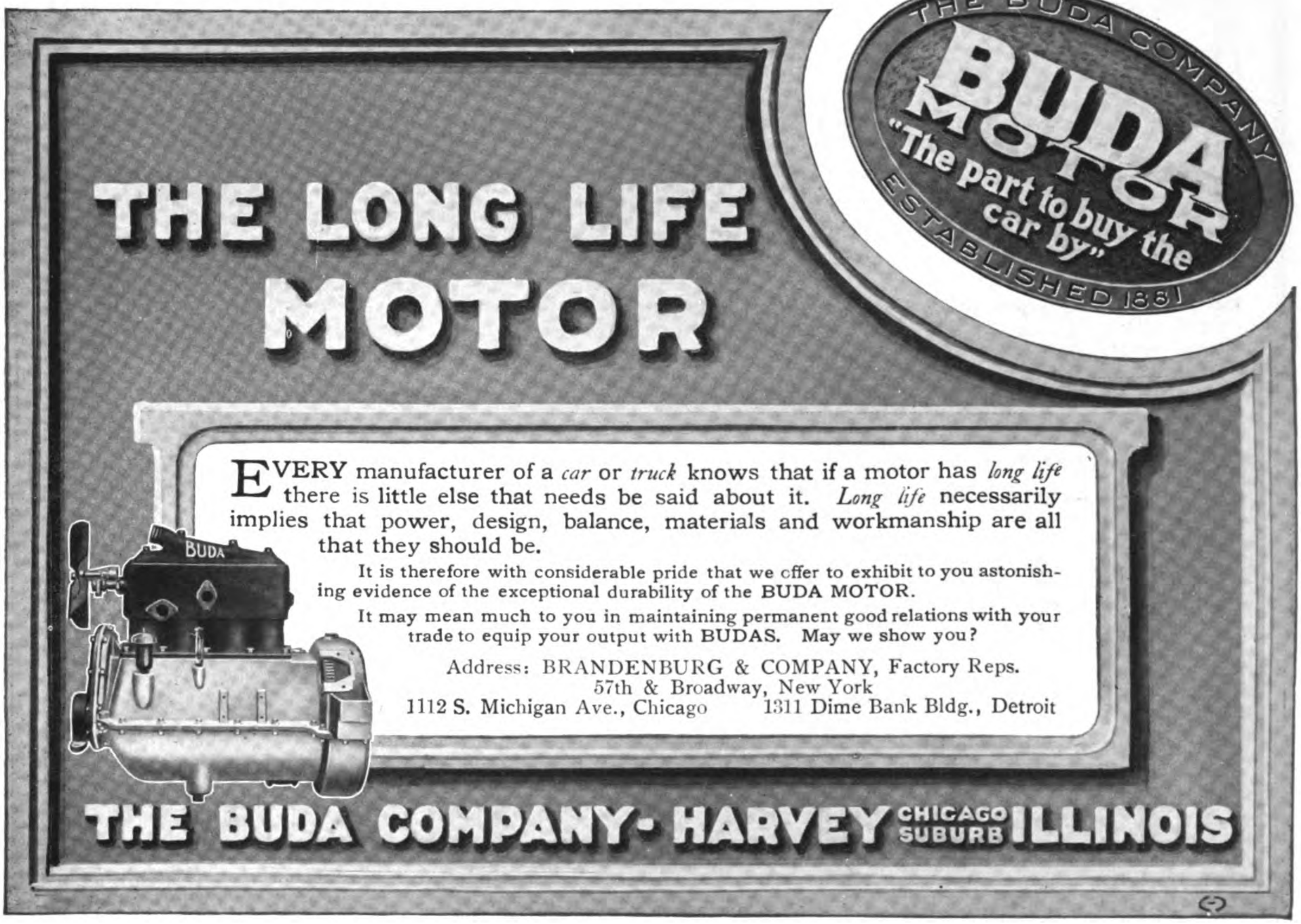

tion between manufacturers, dealers and owners. Meetings will be held every month at which papers on the problems of service will be read and discussed with lectures and moving pictures of men and machines in factories and their operations. The Indianapolis service managers have already been organized and similar organization will probably be formed in Cleveland and Chicago.

The following officers of the Michigan association were elected: President, C. R. Lester, Packard; vice-president, E. P. Rippengill, Hudson; secretary-treasurer, E. H. Hazelton, Regal. Executive committee, J. L. Kenyon, Cadillac; H. O. Weisse, Oakland; H. G. Fitch, Overland; C. W. Matheson, Dodge; Charles Gould, Maxwell, and Pierre Schonn, General Motors Truck Company.

AUTOCAR COMPANY DOUBLES CAPITAL

The Autocar Company, Ardmore, Penn., has increased its capital from $1,000,000 to $2,000,000. Its output of trucks will also be doubled. The sales of the company have increased 70 per cent. during the past 10 months. This is due entirely to the growing domestic demand, as the company has taken no war orders. The new stock is not offered to the public, but is being taken by the original founders. More than 3000 Autocar trucks are in use.

DEALERS BEAT JUNK SHOP LAW.

The Boston motor truck dealers have successfully fought the junk shop law, which required them to take out a $5 license to deal in second-hand cars and required that they hold a car 30 days before they sold it. F. A. Hinchcliffe was arrested for violating both sections of the law and the Boston Automobile Dealers' Association fought the case in the courts. A ruling that the law did not apply to automobile dealers was obtained.

COLUMBUS MAIL SERVICE MOTORIZED.

Seven additional motor vehicles, making 17 in all, have been added to the mail fleet of the postoffice in Columbus, O. Only two-horse wagons, which are used in delivering parcel post packages in the congested districts, are now in service. Thirty minutes have been saved in handling all of the important mails.

Ten thousand names were entered for the $100 prize for a trade name for the new tool steel to be marketed by Joseph Ryerson & Co. The name chosen was Ryolite, which was suggested by both Robert H. M. McNeilly of Nashville, Tenn., and P. R. Kohlsdorf of Milwaukee, Wis.

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Buyers' Reference and Guide

(Yearly Advertisers Only Are Listed in This Guide.)

ACCESSORY MANUFACTURERS AND JOBBERS.

Auto Parts Co., Providence, R. I.

Faw, J. H., Inc., 41 Warren St., New York City.

Times Square Auto Co., 56th St., at Broadway, New York City.

AIR COMPRESSORS AND TANKS.

Brunner Mfg. Co., Main Office and Factory, Utica, N. Y.; New York Office, Hudson Terminal Bldg., 30 Church St. (Brunner.)

Williams Foundry & Machine Co., Akron, O.

AIR PUMPS.

Gardiner Governor Co., 126 Williamson St., Quincy, Ill.

Lipman Air Appliance Co., 199 Pleasant St., Beloit, Wis. (Portable, Stationary.)

ANTI-RATTLERS.

King Specialty Mfg. Co., Brookline, Mass.

AUTOMOBILE ACCESSORIES.

Motorcycle Accessories Co., St. Paul, Minn.

AUTOMOBILES. (See Cars.)

AUTOMOBILE SPECIALTIES.

Motor Specialties Co., Waltham, Mass.

AUTO SPRINGS. (Boltless.)

Harvey Spring Company, 851 17th St., Racine, Wis.

AUTO STORAGE COVER.

Kennedy Car Liner & Bag Co., Shelbyville, Ind.

AXLES.

Russel Motor Axle Co., No. Detroit, Mich. (Internal Gear Drive.)

BALLS AND BALL BEARINGS.

Ahlberg Bearing Co., 2624 Michigan Ave., Chicago; 1790 Broadway, New York City; 805 Woodward Ave., Detroit.

Boyd, F. Shirley, 175 Massachusetts Ave., Boston. (R. I. V.)

Marburg Bros., Inc., 1790 Broadway, New York. (S. R. O.)

New Departure Mfg. Co., Bristol, Conn. (New Departure.)

Norma Co. of America, 1790 Broadway, New York City. (Norma.)

BODIES—WOOD AND METAL.

Cotton, Inc., L. M., Boston, Mass.

Springfield Metal Body Co., 20 Medford Ave., Springfield, Mass.

BOLTLESS AUTO SPRINGS.

Harvey Spring Company, 851 17th St., Racine, Wis.

BRAKE BANDING OR LINING.

Boyd, F. Shirley, 175 Massachusetts Ave., Boston. (Multibestos.)

Standard Woven Fabric Co., Framingham, Mass. (Multibestos.)

Staybestos Mfg. Co., Lena and Armat Sts., Germantown, Philadelphia, Penn. (Staybestos.)

Thermold Rubber Co., Trenton, N. J.

BRUSHES, WIRE.

Williams Foundry & Machine Co., Akron, O.

CABLE, AUTOMOBILE.

Faw, J. H., Inc., 41 Warren St., New York City. (Standard American.)

Packard Electric Co., The, Warren, O.

CARBON REMOVERS. (See Cylinder Cleaning Compound.)

CARBURETORS.

Zenith Carburetor Co., Detroit. (Zenith.)

CARS—GASOLINE PLEASURE.

Inter-State Motor Co., 804 West Willard St., Muncie, Ind. (Inter-State.)

Metz Co., Waltham, Mass. (Metz.)

Nordyke & Marmon Co., Indianapolis. (Marmon.)

Peerless Motor Car Co., Cleveland, O. (Peerless.)

Pierce-Arrow Motor Car Co., Buffalo, N. Y. (Pierce-Arrow.)

Reo Motor Co., Lansing, Mich.

Scripps-Booth Co., Detroit. (Scripps-Booth.)

Stutz Motor Car Co., Indianapolis. (Stutz.)

White Co., Cleveland, O. (White.)

Willys-Overland Co., Toledo, O. (Overland.)

Winton Co., 131 Berea Road, Cleveland, O. (Winton.)

CARS—GASOLINE COMMERCIAL.

Bessemer Motor Truck Co., Grove City, Penn. (Bessemer.)

Chase Motor Truck Co., 106 West St., Syracuse, N. Y.

Duplex Power Car Co., Charlotte, Mich. (Duplex.)

Federal Motor Truck Co., Junction and Leavitt Sts., Detroit. (Federal.)

General Motors Truck Co., 26 Cadillac Ave., Pontiac, Mich. (GMC.)

Independent Motors Co., Port Huron, Mich. (Independent.)

International Motor Co., 64th St. and West End Ave., New York, N. Y. (Mack.)

Jeffery Co., Thos. B., Kenosha, Wis.

Kissel Motor Car Co., 196 Kissel Ave., Hartford, Wis.

Locomobile Company of America, Bridgeport, Conn.

Packard Motor Car Co., Detroit, Mich.

Peerless Motor Car Co., Cleveland, O. (Peerless.)

Pierce-Arrow Motor Car Co., Buffalo, N. Y. (Pierce-Arrow.)

Reo Motor Co., Lansing, Mich.

Signal Motor Truck Co., Detroit. (Signal.)

Sullivan Motor Car Co., Rochester, N. Y. (Sullivan.)

White Co., Cleveland, O. (White.)

CARS—ELECTRIC COMMERCIAL.

General Motors Truck Co., 26 Cadillac Ave., Pontiac, Mich. (GMC.)

General Vehicle Co., Long Island, N. Y.

CHAINS, TIRE AND ANTI-SKIDDING DEVICES.

Weed Chain Tire Grip Co., 28 Moore St., New York City. (Weed.)

CHAINS—TRANSMISSION OR DRIVING.

Boyd, F. Shirley, 175 Massachusetts Ave., Boston. (Baldwin.)

CIGAR LIGHTERS. (See Lighters.)

COILS.

Heinze Electric Co., Lowell, Mass.

CONTROLLERS.

Pierce Speed Controller Co., Anderson, Ind.

CRANK HOLDERS.

King Specialty Co., Brookline, Mass. (King.)

CYLINDER CLEANING COMPOUND.

Dyer Apparatus Co., Cambridge, Mass. (Oxy-Carbon.)

ELECTRIC LIGHTING EQUIPMENT.

Carleton Co., The, 172 Summer St., Boston. (New Carleton No. 68.)

Culver-Stearns Mfg. Co., Worcester, Mass.; Detroit.

ELECTRIC TROUBLE SHOOTER.

American Bureau of Engineering, 1526 Wabash Ave., Chicago, Ill. (Ambu.)

ENGINES, GAS, GASOLINE, KEROSENE.

Manufacturer's Engine Company, Kansas City, Mo.

FAN BELTS.

Housel Sales Co., B Street, Buffalo, N. Y.

FIRE EXTINGUISHERS.

Pyrene Co. of N. E., 88 Broad St., Boston.

FORD GASOLINE GAUGES.

Housel Sales Co., B Street, Buffalo, N. Y.

FORD HOODS AND RADIATORS.

Superior Lamp Mfg. Co., 136 W. 52nd St., New York, N. Y.

FORD STARTERS.

Hunter Auto Supply Co., Hunter Bldg., 333 W. Madison St., Chicago, Ill. (Hunter.)

Picard & Co., A. J. 1720 Broadway, New York City. (Genemotor.)

Walden Mfg. Co., 73 Commercial St., Worcester, Mass.

FOUR WHEEL DRIVE.

Four Wheel Drive Auto Co., Clintonville, Wis.

FUNNELS, AUTO.

Dover Stamping & Manufacturing Co., Cambridge, Mass. (Dover.)

GAS ENGINES.

Manufacturer's Engine Company, Kansas City, Mo.

GASOLINE ENGINES.

Manufacturer's Engine Company, Kansas City, Mo.

GEAR SETS.

Detroit Radiator Spec. Co., 961 Woodward Ave., Detroit, Mich.

GEARS, STEERING.

Ross Gear & Tool Co., 794 Heath St., Lafayette, Ind. (Ross.)

GENERATORS.

Carleton Co., The, 172 Summer St., Boston. (New Carleton No. 68.)

HEATERS.

Superior Mfg. Co., N. S. Pittsburg, Penn. (Superior Safe Garage.)

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The MOTOR TRUCK

Devoted to Motor Driven Business Vehicles of All Classes.

VOL. VI. PAWTUCKET, R. I., DECEMBER, 1915 No. 12

MOTOR TRUCKS SAVE BIG PLANT INVESTMENT.

Weber-McLoughlin Company, New York City Coal Dealer, Realizes Double Economy by the Operation of Fleet of Seven-Ton Machines for Delivery in Manhattan, the Bronx and Yonkers from Two Tidewater Yards.

ECONOMY in highway haulage may be considered from many different angles, and while there is possibility of combining some or a number of the factors that will bring about economies in facilities, equipment or organization, careful analysis frequently develops that but one of numerous possibilities for economies will result in a very material saving.

In any consideration of cost the local operating conditions must have a very important bearing, because these factors are extremely variable, and comparison of the items of expense in different localities will not afford any real knowledge of them. By this is meant that the only accurate measure is the cost of practically the same work done by varying methods, facilities and means of haulage, which will be under the one supervision.

One must weigh carefully the fact that any well managed business enterprise must afford its customers rapid delivery, because of the needs of competition, and the purpose is to obtain this necessary service at the smallest expense that is practicable. The larger and more populous the community the greater the demands upon a concern, and the stronger the need of meeting these to the satisfaction of its customers.

Six Seven-Ton Saurer Trucks at the Concrete Pockets at the Yard at 132nd Street and the North River.

Haulage in New York City is necessarily more expensive than elsewhere in the country because of the extreme congestion of the street traffic during the working hours of the day, the high real estate values that increases the rentals of stables, garages and warehouses, the fixing of wages and hours of labor by organizations of employees, the long distances that must be covered to make and the quick service impelled by competition.

Comparisons of transportation costs in New York City and in other sections of the country would probably show a much increased operating expense for the metropolis, no matter whether the basis was ton-miles, miles, tonnage or any other standard. One of the principal items would be the fixed charges, and of these capital invested in real estate, or rent paid, would be exceptionally large—in fact, much larger than would be believed by those not possessed of definite information.

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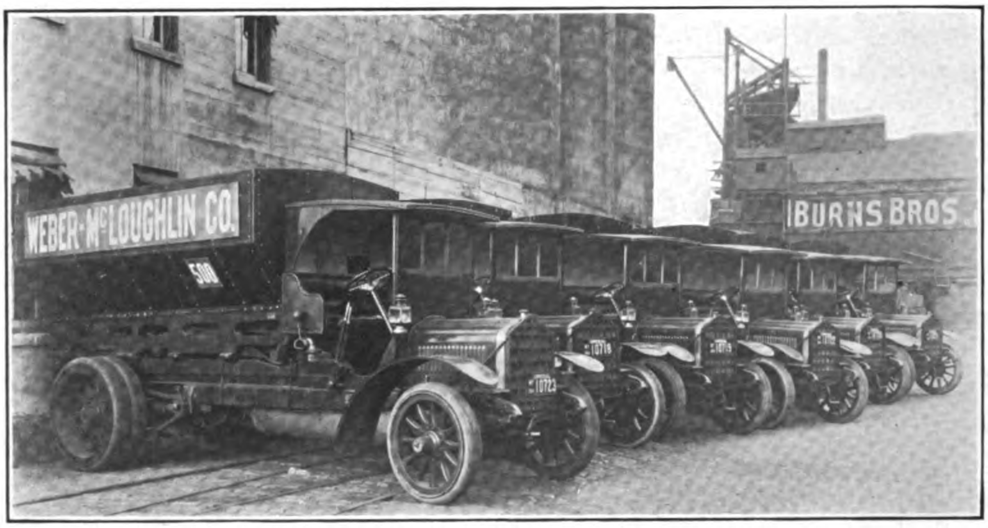
In such cities as New York those who would confine their business to limited areas because of the expense of delivery cannot be regarded as representative firms. Those that would serve customers in all parts of the municipality must necessarily have large equipment and to save haulage must have branches or points from which distribution may be made to minimize the expense of transportation.

The business that would have service for customers in a considerable part of the city and yet have the fewest branches because of the cost of what may be regarded as plant investment, must meet the problem of affording service that will meet that of competing concerns at expense that is justified by the volume of the transactions.

Where Comparative Data Is Certain.

The experience of the Weber-McLoughlin Company, coal dealer, which serves the greater part of the island of Manhattan, the borough of the Bronx and a part of the city of Yonkers, largely with motor truck delivery, is especially interesting because of the economies obtained and the superior service afforded. This company had its only yard until December, 1914, at 132nd and 133rd streets and the North river, occupying a property between 12th avenue and the river and a pier. The concern had been established a number of years and its customers were very largely hotels, apartment houses and manufacturing establishments on Manhattan island, north of 59th street.

The very rapid development of the Bronx and Harlem sections of the city necessitated either limiting its delivery to certain sections and foregoing what promised to be constant and profitable trade in Harlem and the Bronx and the southern part of Yonkers, or expansion of facilities and equipment. The company's customers naturally wished to do business with one firm so far as possible. To divide patronage would mean the sacrifice of the advantage of larger contracts and possibly result in lessening responsibility on the part of the contractors, which was not desired by the customers, and so far as the company was concerned there was no disposition to neglect patrons with whom satisfactory relations existed.



These Seven-Ton Saurer Trucks Are Worked with Four Seven-Ton Alco Machines from One Garage and Serve Both Tidewater Yards.

The Topography of the City.

The company, like practically all concerns that had been established for a number of years, originally did all its haulage with horses. From a business that was at first practically in the western section of Harlem, the delivery zone was gradually extended. Twelfth avenue extends along the shore of the North river, there being access from this street to the docks, and from this there is an ascent to the ridge that runs north and south, on which Broadway is nearly at the crest. The slope from Broadway west to the river is quite steep, and from Broadway east there is a comparatively level section that gradually slopes toward the East river, and then somewhat more abruptly toward the Harlem river.

Broadway is not at a uniform grade. From 110th street north there are alternating descents and ascents, there being a sharp drop from 125th street to 129th and Manhattan streets, and a sharp rise from that point to 133rd street. There are similar grades from 146th street to 152nd street, and from 154th street to 161st street. Broadway is the main artery of travel directly north. South of 140th street the Riverside drive, and further north the Lafayette boulevard. are sought by those driving for pleasure, but Broadway is wide and asphalt paved, and there are bridges across the Harlem river convenient for those seeking to reach the Bronx. Broadway can be followed with comparatively straight connecting streets to Getty square at Yonkers. That is, there is a direct route north from the Battery into the centre of Yonkers.

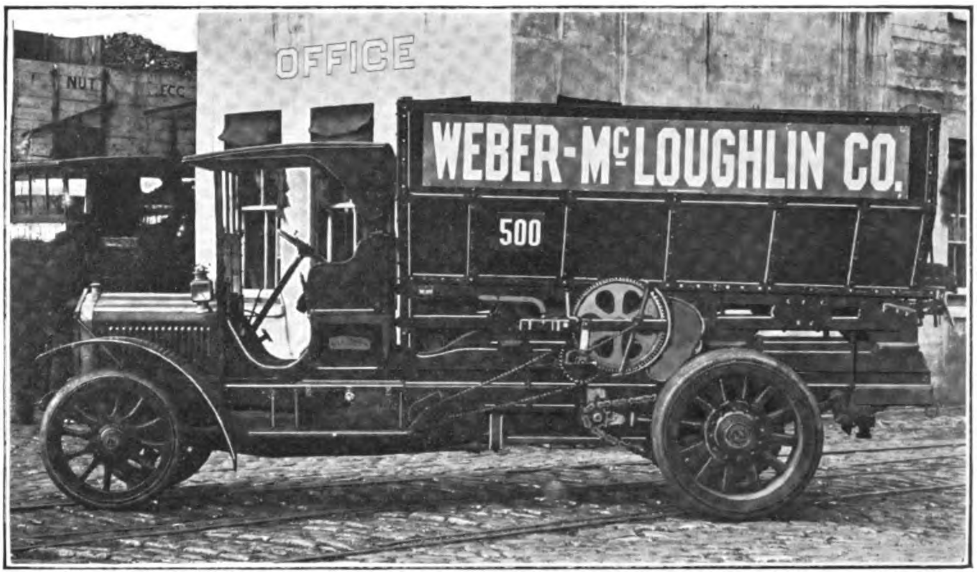
The Harlem River Crossings.

The Harlem river is narrow as compared with either the North or East rivers, being practically a ship canal between the two, that is being more and more used for direct delivery by water to manufacturing plants and yards located on either side of it. Manhattan island is narrow and at approximately 190th street there is Fort George at the right and Washington Heights at the left, both being close respectively to the Harlem and the North rivers. At what would be about 200th street is the end of the West Side branch of the subway system. At this point as well there are a series of streets direct from Broadway to the Harlem river. There are highway bridges crossing the Harlem river at Willis avenue, Third avenue, 138th street, Macomb dam at 155th street, High bridge at 174th street and Washington bridge at 185th street. These all afford access to the south and west sides of the Bronx

and there are bridges north of these.

The first coal yard of the Weber & McLoughlin Company was located with two purposes in view, the one being to minimize haulage by vehicle by establishing it as near as possible to the centre of the section of the city in which business was to be done, and the second was to have it at the water front to economize handling. The coal, both bituminous and anthracite, is received at the nearby New Jersey ports, South Amboy, Amboy, Perth Amboy, Bayonne, Jersey City, Hoboken and Weehawken, in trains loaded at the mines, and it is loaded into open scows and towed to the company's pier, where it is unloaded by machinery and stored in pockets.

When horses were used for distribution the zone in which they could be used advantageously was limited. Leaving the yard at 132nd street the teams were driven south in 12th avenue to Manhattan street, which gave a fairly level route directly east, but going north or south the animals had to climb the grades on Broadway, and when the paving was wet, muddy or covered with ice or snow, teams of two horses with extra men were stationed there to haul the loaded carts to the tops of the ascents. According to President Weber as many as 12 tow teams of two horses and as many drivers were kept at Manhattan street during the working hours of the day, which was a heavy expense that was necessitated by consideration for the animals.



Seven-Ton Saurer Truck Chassis Equipped with Hunt Power Hoist to Discharge the Loads by Gravity When Possible.

No attempt was made to drive from the yard through 132nd street to Broadway at any time because of the long hill, although this would have been a direct way of going north. The shorter and steeper grades of Broadway were preferred, despite the longer distance. With the inevitable expansion of business deliveries were extended until they were made as far south as 59th street, a distance of about 3½ miles from the yard, where the island is about 2½ miles wide, and north as far as the line of the Harlem river and across the river into the western part of the Bronx.

The company erected what may be regarded as one of the best coal yard plants in New York City, although not the largest. The pockets are great cylinders of steel reinforced concrete, adapted for gravity loading by chutes, these having the advantage of long endurance, large capacity for the ground area occupied and not deteriorating because of influences of the weather. These pockets have capacity of approximately 3500 tons. These were in addition to wooden pockets that were regarded as still useful and which will eventually be replaced with concrete structures.

With these yard facilities the fullest possibilities of economic handling and loading of coal were realized, but the haulage equipment was not sufficient or adequate. In the summer of 1911 the company decided to experiment with motor trucks and to use them instead of purchasing horses. Four Alco 6½-ton trucks were ordered and pending the delivery of these machines a stable in 131st street was made fireproof and converted into a garage, which had floor space for 10 trucks. This did not necessitate an addition to the property.

A mechanic was hired to keep the trucks in good condition mechanically and because of the fact that there are machine and wood working shops of all kinds located close to the garage, no especial facilities for repairing were provided. The resources of the service station were available whenever replacements were necessary. The system decided on for caring for the machines gave the mechanic the assistance of the driver whenever work that required help was necessary, as this insured the drivers obtaining training that would be useful to them in their regular work. One of the duties of the mechanic was to inspect the machines daily and see that they were in condition for use, and to supervise the oiling, greasing, filling of tanks, etc. There was, of course, a thoroughly good hand tool equipment for each machine and the garage.

Trucks Equipped to Obtain Economy.

In equipping these trucks steel end discharge bodies were installed, these being fitted with outlets from which chutes could be extended. The bodies have sides shaped so that the loads will concentrate from gravity, and but little if any "trimming" is necessary for discharging. The bodies are elevated by Hunt power hoists that are driven from the transmission gearset of the main driving system, and about 20 seconds is usually required to raise a body. The cabs are so designed that they may be entirely closed in the

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event of rain or cold weather, and the drivers may not be exposed for any length of time to severe temperatures. This protection is used the entire year, but the sides are removable during the warmer months.

The trucks were placed in service practically at the beginning of the hardest work of the year and were used for the long hauls. There was no reduction of the number of horses, but these were worked nearer to the yard and where loads of less than truck capacity or of two or more orders were delivered. There were generally sufficient orders so that there was no need of working the machines for anything else than the capacity load hauls and in conditions where discharging could be done by elevating the bodies. Experiments were made with the trucks to be sure, to determine just what was practical and economical, and by accounting for the time of the trips and the mileage and loads carried very accurate data regarding the work was obtained.

Truck Body Elevated by Hunt Power Hoist, This Being the Equipment of All the Machines Operated by the Company.

Practically all coal carts drawn by horses have a crew of a driver and a helper, and where the conditions for loading are such that additional help is economical, a third man is sent. This is the general custom with all New York City coal firms. As with horse carts the bodies must be elevated by hand, the contracts made with the drivers' unions require that the driver shall have a helper, and this is an expense that must be borne by all concerns operating horses. The union rules provide, however, that a helper is not required with trucks equipped with power hoists, so that there was a considerable economy in labor as compared with carts having equal capacity. Although the drivers of the trucks are paid more than the horse drivers, the labor cost for the trucks is but 66 cents a day more than for a three-horse team.

In this respect the labor unions discriminate in favor of the truck in coal haulage. The claim is made that where the hauls are short and the loads are frequent in the course of a day there is considerably less manual work for the driver of the truck as compared with the driver of the horse cart, and as he is better paid he can get on very well without help unless the load must be carried in, in which event the time of the machine is of greater importance to the dealer than the saving of labor.

There is a freight track of the New York Central railroad between the river front and 12th avenue and there was at that time no crossing at the foot of 132nd street. The nearest entrance to the Weber-McLoughlin company's yard was by the crossing at 129th street. When the trucks climbed the Broadway hills from Manhattan street with capacity loads in all kinds of street conditions, the shorter way to the north through 132nd street was regarded as a means of saving time as worthy of consideration. The railroad company had successfully resisted for 30 years any endeavors to establish a crossing, but the company renewed the legal battle and won it in a month. This also opened a shorter way to the garage.

After working the four trucks about two years the company's business had so much extended that it could not be economically served from the one yard and with the intention of making delivery in practically all of the Bronx and in Yonkers south of Getty square, plans were made for expansion. To use horses at least three yards would be necessary because of the necessity of economizing haulage cost, but to establish yards meant permanent investment of a large amount of money. With wooden pockets that would last for a few years the expense might be materially lessened, but ultimate result would be renewals and greatly increased cost, while real estate values are so subject to appreciation that few men care to make estimate of them.

To erect concrete pockets, which would be the cheapest in the end, would mean large initial cost for land and structures, greater fixed charges and decidedly smaller upkeep expense. With two yards the investment would be practically doubled. With this prospect the chief problem was economy, and so decision was reached to erect a plant at the foot of 215th street, at the Harlem river, where there would be practically the same unloading facilities as there were at 132nd street, and where the only additional cost would be the towage of the scows or barges from the North river.

Fleet Increased to 10 Trucks.

The plant was built in 1914 and it was ready for operation Dec. 1, and from this the trade on Manhat-

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tan island north of 185th street and in Yonkers to Getty square, as well as the Bronx, aside from the extreme eastern part, is served. Six seven-ton Saurer trucks, each fitted with practically the same body equipment and the enclosed cabs, were purchased from the International Motor Company and delivered just before the new plant was in readiness for operation.

The equipment of the company now consists of 10 seven-ton trucks and 38 horses that are worked with carts within comparatively short distances of the yards, or on hauls that will average two miles. All the other haulage is done with the trucks. The machines are all kept at the 132nd street garage and these are assigned for work according to the orders at the two yards. Those going to the 215th street yard in the morning carry out loads for delivery en route, and then the drivers report to the yard for instructions. The other machines are worked direct from the 132nd street yard. When the trucks return from the upper yard late in the day, so far as possible they carry loads. This economizes on the mileage and this division of the work compensates for the dead mileage that otherwise might result from practically a four-mile run from yard to garage.

Extent of Territory Operated In.

From 132nd street to 59th street is about 3½ miles, and to 185th street three miles, and from that point to Getty square about 4½ miles, making the length of the delivery zone about 11 miles in a direct line, and it ranges from 2½ to six miles wide. In this the trucks are driven an average of 32.5 miles a day, and the average number of deliveries will vary from eight to 10. About 10 minutes is allowed for discharging, and as the loading is by gravity, this work is done very quickly. System is carefully observed and the trucks are worked under the supervision of President Weber, who realizes that their economy is mainly obtained through keeping them moving.

The drivers are encouraged to do their work well and their comfort so far as possible is a first consideration. Saving labor means saving time and money. The machines in the time of need, when horses cannot do their best because of weather or street conditions, have always been worked to capacity, and when necessary for long periods of overtime. In the summer, when there is the least work, the trucks can be laid off with material lessening of operating expense, or can be overhauled. The horses must be worked sufficiently to condition them in any event, and overwork or underwork is equally bad. When they are most needed they are the least efficient.

Will Buy No More Horses.

President Weber says that the company will buy no more horses. As those now owned become unserviceable they will be replaced with trucks. He has not experimented with lighter and faster machines for family and smaller deliveries, but he believes from the experience of the company that the requirements can be worked out satisfactorily. He does not wish to state how great a saving he has made with trucks, for he believes that data should not be given to others to benefit through experience he has obtained by four years careful study and observation, but he says that the policy of buying no more horses ought to demonstrate his faith in the service obtained with machines.

He does say, however, that to serve his customers equally well without trucks the company would have had to establish a third yard, and a plant that would be the most economical investment to make would have cost at least $150,000 additional, and in addition to this there would be the constant operating expense that would be a material item. He believes that he can serve the territory in which his company now operates with the two yards quite as well as he could with three yards, and for that reason his trucks have saved the company what would be represented by the investment, as well as expense of operation. This economy alone would be a very large factor, but besides this there is the saving that was obtainable from trucks and which impelled the purchase of the last six machines. The aggregate of these economies is undoubtedly large.

This is a result in the largest city of America. There is one condition that may not be realized, and that is that there is comparatively little time lost from traffic congestion in the sections where the trucks are used, and for this reason machines can be worked to better advantage than in the lower end of Manhattan, but where the trucks are used the streets are travelled by vehicles probably as much, if not more, than in the majority of American cities.

NILES CAR COMPANY TO MAKE TRUCKS.

The establishment of a motor truck department has been determined by the Niles Car and Manufacturing Company of Niles, O., which has devoted itself exclusively to trolley cars and electric interurban cars, turning out recently an all-steel type of car.

The directors of the company had this plan under consideration, but as a change was necessary in the company's charter the proposition was submitted to the stockholders.

Installation of additional machinery necessary for truck manufacture will be begun at once and the department equipped as rapidly as possible to build the machines.

"THE SPRINGS ON YOUR CAR."

A booklet with the title given above has been issued by the Detroit Steel Products Company, Detroit, Mich., which will be sent free to any one interested in springs. It gives all the facts about springs, theory, practise and history, in a clear, non-technical way that any one can understand. It is written by an engineer who understand springs thoroughly and who treats of his subject interestingly. The book should concern every owner who is interested in the whys and wherefores of motor car construction.

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BRITONS IN WAR PROFIT SUIT.

Truck Sale Commissions of $100,000 from Russian Order in Controversy.

H. G. Burford and Warwick Wright, two prominent Englishmen, are the parties to a suit which has just been brought in New York regarding war profits resulting from placing an order for $6,000,000 worth of truck orders for the Russian government.

Burford, who is head of the H. G. Burford Company of London, has been very prominent in the Anglo-American truck situation since the war began. He bought the Lauth-Juergens truck plant, changed the name of the product to the Burford truck and has been disposing of large numbers.

The present suit is brought against him by Warwick Wright. Wright claims that when war broke out he made a connection with the Morton Truck and Tractor Company of Harrisburg, Penn., which was in a position to take war orders and undertook to dispose of the output of the company.

A Fleet of Seven Worm-Driven Packard Trucks That Has Been Attached to the Detroit, Mich., Post Office, Carrying Bulk Mail.

Burford has great influence in English government circles owing to the fact that a former secretary of state for war of the British empire is a member of his firm. Wright went to him and offered to split the commissions, 50-50, on any orders that Burford might be able with his influence to get.

The $6,000,000 worth of orders for the Morton firm followed. The commission on this business amounted to about $100,000 and Wright demands half of it. He was in England and on returning to this country discovered that the commissions had been paid to Burford. The latter refused to divide and sailed for England.

Wright then retained a New York attorney and began suit.

The Milwaukee assembling plant of the Ford Motor Company is to open Feb. 1. After 3100 applications had been received for the 400 jobs that will be open the company was forced to announce that no more of them would be considered.

GUARDS FOR OPEN BRIDGES.

The county engineer of Essex county, N. J., may install on the drawbridges within his jurisdiction a device to prevent motor cars running off the ends of open bridges. Such a device is now in use at Green Bay, Wis. A chain is attached to a post at either side of the roadway. These posts are connected with drums on which are strong brakes and several yards of the chain are wound around each drum. When pressure is brought upon the chain it yields very slowly through the drums revolving against the brakes. The greater the pressure the stronger resistance against the drums. The device is said to have capacity to stop quickly a 4000-pound automobile moving at the rate of 50 miles an hour.

TRUCK DEMAND IN CUBA.

Although the number of passenger cars in use in Cuba has increased rapidly during recent years, the use of trucks has not grown correspondingly. There is a likelihood now, however, that more trucks will be purchased. Practically all hay and horse feed must be imported, so that using animals is expensive, which is another factor that makes for the economy of motor trucks.

Last year's sugar crop was sold for $200,000,000 and the mills are now working on a new crop that will be even larger. Money is plentiful and trucks are sure to be purchased. Mail negotiations are difficult and usually unsuccessful. A good Spanish speaking salesman or representation by a Cuban firm is desirable for the American truck manufacturer who wishes to exploit this market.

NEW TRUCKS AT DETROIT POSTOFFICE.

A fleet of seven worm driven trucks has been placed in service at the Detroit, Mich., postoffice to carry mails. These replaced chain driven trucks that were transferred to another city. They have regulation screen side bodies and are painted in the national colors, as is required by the Postoffice Department. They are designed chiefly to carry bulk mail, but seats are provided inside so that they can be used in transporting letter carriers.

The Lenox Motor Car Company of Boston is said to have closed a contract for from 500 to 1000 trucks for the allies. Hyde Park, Lawrence and Fall River shops are expected to make the parts.

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THE SANFORD MODEL R 2000-2500 POUND TRUCK.

AN INTERNAL gear drive truck, built of well known parts of the highest quality and conforming to well proven design, is the model R machine produced by the Sanford Motor Truck Company, Syracuse, N. Y. The power transmission system includes an internal gear drive rear axle which is one of the best known products of the industry.

The Sanford model R truck has a capacity of from 2000 to 2500 pounds and a wheelbase of 138 inches, which affords ample room for a body of large size. The chassis sells for $1370 in lead paint and with an express type body it can be had for $1430 complete. Bodies of other types are also supplied to meet specific needs.

A Buda motor is used that has four cylinders cast en bloc with 3½-inch bore and 5⅛-inch stroke. The crankshaft is supported on three main bearings. This motor is not in any sense a passenger car motor, but has been designed with ample weight and size especially for truck work. It will develop 25 horsepower at 1500 revolutions a minute.

Large Capacity Cooling System.

The water jackets in the cylinder casting are of exceptionally large size to permit the use of an adequate volume of cooling water. The radiator is also of larger capacity than is usual for a motor of the size used. It is mounted on flexible supports so that no weaving of the frame can cause it to leak.

A belt driven fan of large size and high efficiency is mounted directly behind the radiator. The lubricating system is self-contained and automatic and is a constant level splash type. The oil is circulated by a gear driven pump. A single high-tension magneto with set spark is used for ignition.

The motor is controlled by a foot accelerator. This is the simplest and most easily operated control that can be had and it has the additional advantage of leaving the driver free at all times to use his hands. The steering gear is at the left side and is a screw and nut type. The change gear and emergency brake levers are in the centre of the front compartment, where they can be operated with the right hand.

The clutch is a multiple dry disc type. It is provided with a brake to quickly stop spinning when in neutral and so facilitate the shifting of gears. The clutch may be slipped indefinitely without damage, as it is faced with asbestos.

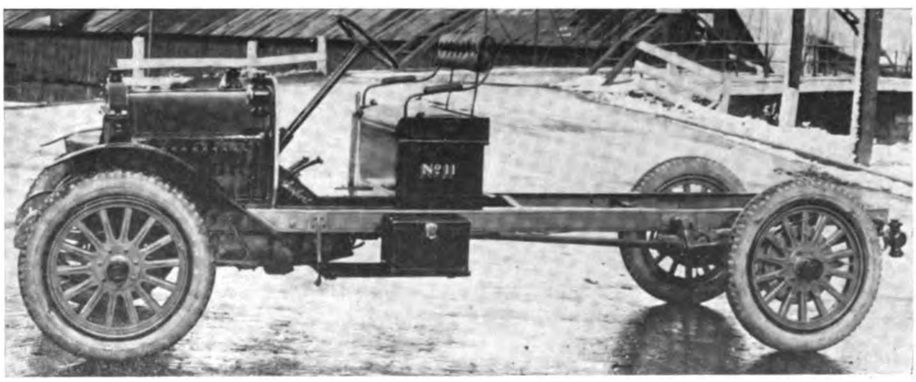
There are three forward speed ratios and reverse in the selective sliding gear transmission gearset. It is assembled with the clutch and the engine in a unit power plant. The entire unit is easily removable or accessible. The gears have exceptionally large faces and wide centres and are made of 3½ per cent. nickel steel.

Internal Gear Drive Axle.

The final drive is by internal gears running in oil, which act directly upon the rear wheels. This type of drive has one of the chief advantages of the chain drive system, as the entire load is carried upon a strong dead axle and the power is applied through floating members directly to the rear wheels. The system is the only one approved by a number of foreign countries for military use.

The front axle is a one-piece I beam drop forging of carefully heat treated stock. The spindles are machined from a heat treated alloy.

The wheels are an artillery type with large hubs and detachable rims made to the S. A. E. standard. The tires used in front are 36 by 3½-inch solid and those in the rear are 36 by four-inch solid. If desired 34 by 4½-inch pneumatics in front and 35 by five-inch pneumatics in the rear may be fitted.



The Sanford Model R Stripped Chassis, an Internal Gear Driven Type Constructed of Carefully Selected Components.

The wheelbase is 138 inches and the tread is 56 inches. The brakes are external contracting and internal expanding on rear wheel drums. Both are very large in diameter and they are lined with material that is highly resistant both to heat and wear.

The springs are semi-elliptic. Those of the front set are two inches wide and 38 inches long. The rear springs are 2½ inches wide and 45 inches long. There are no radius rods and the springs take both the driving and the torque stresses.

The frame is a pressed steel channel section 3/16 by 4½ inches deep with four-inch top flange. It extends practically the entire length of the vehicle. The frame is inswept 2¼ inches in front to facilitate turning.

T. Harris Smith, who has been connected with the Mercury Manufacturing Company, Chicago, Ill., has joined the advertising and sales forces of the Packard Motor Car Company of Detroit. His successor with the Chicago company has not yet been announced.

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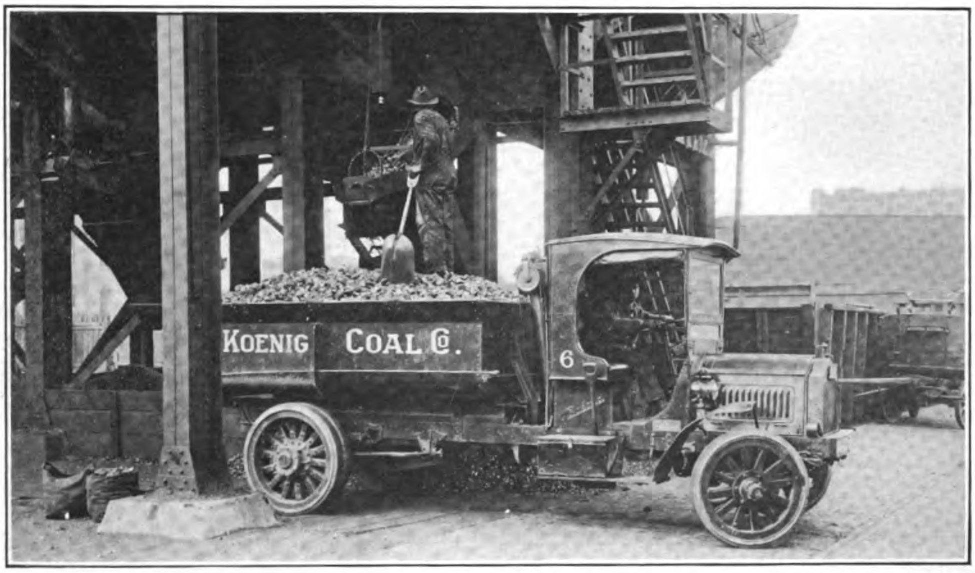
TRUCKS FOR COAL HAULAGE.

Detroit Dealer Eliminates Branch Yards by the Use of Six Machines.

Making deliveries in a community of large size with horse equipment has been a problem that many coal dealers have met by the establishment of branch yards, to which the stock must be hauled and stored before it can be delivered, the saving being largely in the reduction of haulage of small orders. The yards represent whatever investment is essential for the equipment to carry on the business, the purchase or lease of real estate, the erection of pockets or storage bins, stables, scales and the employment of the workers necessary to serve the customers.

The P. Koenig Coal Company, Detroit, Mich., is one of the best known concerns of that city, and its progressiveness is demonstrated by the erection of



One of a Fleet of Six Four-Ton Worm-Driven Packard Trucks Used in Delivery Service of the P. Koenig Coal Company, Detroit, Mich.

steel pockets and every facility for the quick handling of coal in its main yard. Such equipment represents large initial investment, which would only be justified from a knowledge of the economies that obtain by careful investigation and study of the possibilities for saving the time of the vehicles and the labor of the men.

The plant of the company is located in about the geographical centre of the city and its suburbs, and the delivery is made with a combination equipment of six four-ton worm driven Packard trucks equipped with steel end discharging bodies and horse drawn carts. The result has been entirely satisfactory to the firm. Relative to the use of motor trucks, Harman Koenig, a member of the firm, makes this statement:

"The motor truck has eliminated the branch yards, with its increased overhead and additional opportunities for operation troubles. So long as the motor truck continues to give us the satisfaction it has in the past, we shall continue to supply the city of Detroit, its suburbs and occasionally, some of the outlying towns and villages, from our single coal yard.

"We are still operating horse and wagon outfits for short haul delivery, and doubtless will continue to do so, but for long distance delivery—and this means a great many territories within the city limits—the truck is the ideal equipment. In fact, without it, we would be unable to operate without branch yards.

"Our newest truck, a four-ton Packard, is doing the work which formerly required four two-horse teams, and doing it every day. It is not at all unusual for this truck to make eight trips in a single day, only two of which could be accomplished by horses."

MUCH STATE ROAD WORK DONE.

Expenditure of nearly $250,000,000 on the public roads of the United States during 1914 is shown in the report on road work throughout the country of the office of Public Roads and Rural Engineering of the Department of Agriculture.

This includes state aid and the expenditures, of towns, counties and districts, either under the direction of state highway departments or independently. The same report shows that out of appropriations already made there was available on Jan. 1, $54,884,007 of state funds for use on the roads.

As in 1914, when total work to the value of $249,055,067 was done, only $49,414,591 of state money was used, it is reasonable to suppose that the road construction accomplished in 1915 will cost considerably more than that of 1914.

The same report shows that there was in the United States at the end of 1914, 247,490 miles of surfaced road, out of a total of 2,273,131, or a percentage of 10.9. Of the improved roads 35,477 miles has been built under state aid systems.

ENGLAND'S WOMEN TAXICAB DRIVERS.

In the smaller provincial towns of England women taxi drivers have become common since the war developed and are pursuing that business with apparent success. Whether they could be successful under the more severe traffic conditions of the large cities is yet to be determined.

The Fafnir Bearing Company, New Britain, Conn., has opened a branch in Chicago.

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TRACTOR-TILLING INSTEAD OF PLOWING.

The Allis-Chalmers Rotary Tiller, an Invention that Fully Prepares the Land for Crops at a Single Operation to Obtain Its Fullest Productivity.

A NEW machine for preparing the soil for crops which differs in a revolutionary way from the plow and harrow that have been used without change in principle since Pharoah's time, is now being built commercially by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

This machine is known as a rotary tiller and was invented in Germany by K. V. von Meyemburg. It is designed to do the work of the plow, disc and harrow, in one operation, fully preparing the soil for the crop.

Whereas the plow cuts, lifts and breaks the soil, the rotary tiller or soil miller makes chips like a hoe and breaks them into small pieces by throwing them against each other. The plow when used must be followed by a series of other tools to make the seed bed, but the tiller does it all in one operation. It pulverizes the soil to the full depth even when the earth is comparatively heavy.

The machine consists of a light tractor on which is mounted the motor and transmission and of the rotary tiller proper, which is carried behind and on which is mounted the tools or claws for cutting up the soil.

The tiller has one steering wheel in front and two drive wheels in the rear, which are 52 inches in diameter by 11 inches in width. The drive wheels have cast steel rims with horizontal triangular projections on both sides of a flat rim. On the road the machine will run on the flat portion only. The projections come into use more and more as the soil becomes softer and affords less efficient traction.

Large Wheels for Tractor.

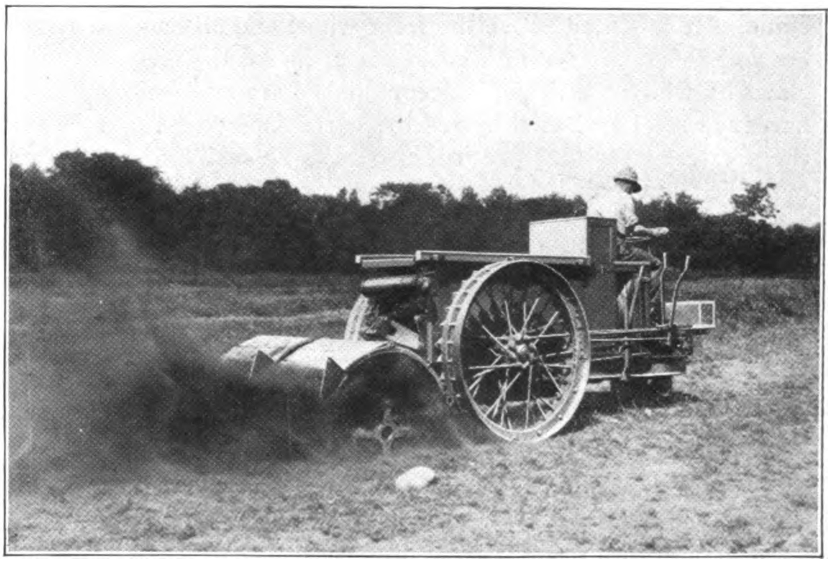
With the tiller attached the weight of the machine is approximately 4500 pounds. The wheels of the tractor are six feet 10 inches in diameter from centre to centre. The whole machine with the tiller is 14 feet over all, so that very little space is required for turning.

The motor is a four-cylinder, four-cycle, vertical type, that will develop 30 horsepower. It is built for tractor service and is provided with a governor. The motor is water cooled, a large radiator being mounted in front of it. The motor is placed lengthwise of the tractor and forward of the driving wheels. It is accessible from both sides.

A multiple disc clutch connects the motor with the gear transmission. Gears are all cut of the best material and the high speed shafts run on ball and roller bearings. All parts, even the gears for the drive wheels, are encased and run in oil. The construction is what is known in automobile practise as the unit power plant.

To operate the tiller a separate shaft is driven by spur gearing from the first gear back of the clutch. This is thrown in and out of action by a jaw clutch. Where it leaves the gear casing another shaft is driven from it through a universal coupling.

This in turn drives the tiller by means of bevel gear and pinion. A casing surrounds the gears. On the shaft which is driven by the bevel gears and which extends from both sides of the casing, are mounted the tiller tools. Gearing for raising and lowering the tiller is also enclosed in the main gear casing. The mechanism is so arranged that the operator simply has to move a hand lever in the same direction for either lifting or lowering. A part of the weight of the tiller is taken up by an adjustable spring.



The Allis-Chalmers Rotary Tiller in Operation, Drawn by a Specially Built Light Tractor.

Shoe Controls Depth of Tiller.

To control the depth at which the tiller is to work a small shoe is hung from the rear casing enclosing the bevel gear drive of the tiller. The greatest depth to which the machine as now designed can till is 12 inches.

The forward motion of the machine is geared to 8/10, 1 1/3 and two miles per hour for tilling and 3.6 miles per hour for traction. As the tiller is five feet wide, from four to 10 acres a day can be prepared for seed according to the speed at which it is operated.

When turns of 180 degrees must be made at the end of the field the tiller is lifted from the soil and lowered again. It is possible, however, to make very

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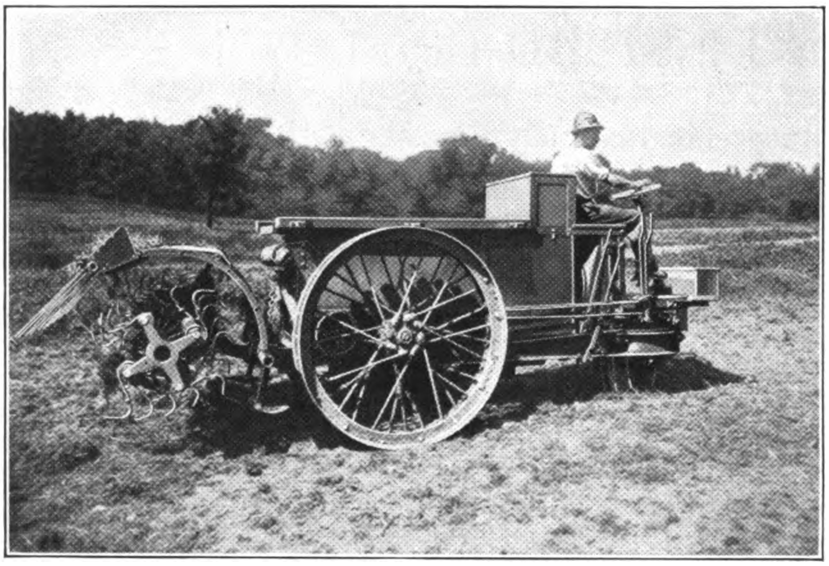

The Tiller Lifted from the Ground for Making a 180-Degree Turn, Showing the General Construction of the Machine.

short turns with the machine, as one driving wheel can be locked with a brake so that the entire machine can be turned around that wheel as a pivot. Both brakes on the rear wheels can be used when at will.

Only one man is required for operating the machine. He is seated above the front wheel and all levers and pedals are within easy reach of his seat. The claws by which the tilling is accomplished are made of hardened steel and as they are the parts subjected to the greatest wear they are made so as to be easily removable from their holders so that they can be readily replaced.

These flexible tools for breaking up the earth are said to have marked advantages over rigid tools for the same purpose. They lessen the shocks on the machine and prevent the breaking of parts when stones are encountered.

Experiment has shown that it takes much less power to drive flexible tools through the soil than rigid ones. The tiller teeth have smaller surfaces in contact with the soil and when they strike small stones they slide off sidewise, instead of pushing the stones through the soil as is the case with a plow. If a claw strikes a stone it cannot dislodge it will recede toward the centre of the rotor and climb over the stone, so that no damage can be done to the machine.

Ground Broken Finely.

The rotor is run at a constant speed. Its circumferential velocity is much greater than the forward movement of the machine. The tractor acts merely as a pace maker, determining the amount of forward motion. If it is run slowly the soil is cut off in very small chips and these are thrown against one another by centrifugal action and broken up into small pieces, so that the earth is left behind the machine in a granulated condition, the sizes of the granules depending on the nature of the soil and the speed of the tractor.

While in many ways the tiller has less difficulty with stones than a plow, it is not especially well adapted for use in stony land for use in clearing land of stones. Its greatest usefulness is for tilling land that is already well cleared and which has been under cultivation for some time.

The tractor is built light, as no traction is required to move the machine forward. The tiller operates in such a direction that it constantly pushes the tractor along. The lighter weight of the machine made possible in this way prevents the soil from being packed down hard as it is under the wheels of a heavy tractor and plow.

The light weight of the tractor requires less power to move it over the land than is necessary for tractors that pull plows. More power is, therefore, applied to doing useful work on the soil.

One disadvantage which this light tractor has is that when it is disconnected from the tiller to be used for other purposes it has not so much tractive efficiency as the heavier types and for that reason its utility as a tractor pure and simple is somewhat limited. It was designed, however, especially for use with the tiller and is perfectly adapted to that function.

No Crust Under Soil.

When a plow is used the soil in the bottom of the furrow is consolidated and the pores are closed up. The result is that the passage of moisture between the subsoil and the cultivated soil is not free. When the tiller is used nothing of this sort happens and the passage of moisture through the earth from top to bottom is not impeded. The occasional deep tilling to break up the crust caused by plowing, which is necessary under the

The Machine Being Driven Across a Field with the Tiller Elevated, This Showing the Ease of Operating.

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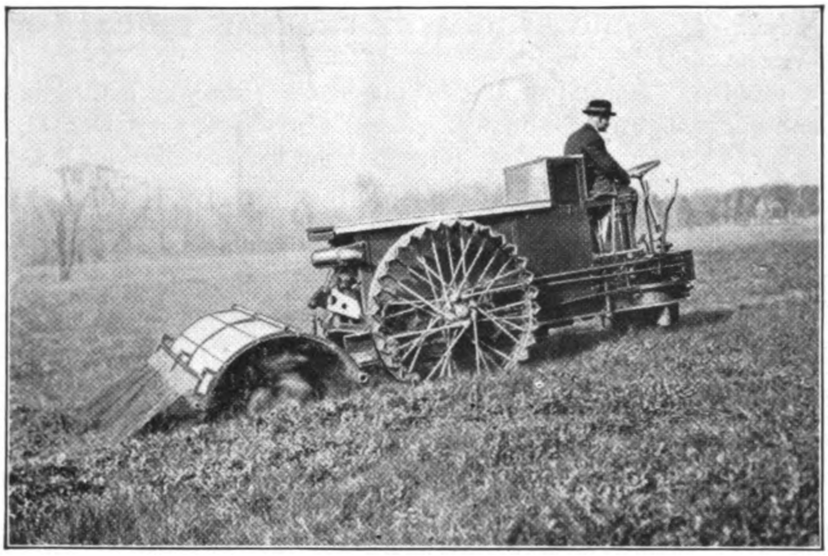


The Tiller at Work in a Field, the Rotating Tools Being Carried Deeply Into the Soil as It Moved Forward.

old systems of land preparation, is therefore, obviated.

The rotary tiller is said to aerate the soil very thoroughly, bringing it into a condition that is common with garden soil. No large, solid lumps are left in it to be broken up by frost. The density of the soil decreases toward the top, which is the ideal condition for crop growth. A dust mulch is produced on top of the soil, which effectually prevents the evaporation of moisture, provided the earth is of the right sort. Tilled soil will hold water much better than plowed land.

The tiller thoroughly distributes manure through the soil, instead of merely turning it under, as is the case with the plow. No lumps are left on the surface to turn into peat. Because of this more efficient distribution through the soil a greater benefit is received from the manure.

Feed boxes are provided on the tractor in which supplies of fertilizer may be placed and delivered to the ground just in front of the tiller to be mixed with the soil much more thoroughly than is possible with the usual methods of preparation.

Another advantage claimed for the tiller is that on soil prepared by it a smaller amount of seed is required on account of the more uniform structure of the soil. Experience with tiller in Europe shows that from 20 to 30 per cent. of the seed can be saved in this way.

Larger Crops Grown.

Larger yields are produced from tilled than from plowed land. Careful comparative tests made in Europe showed that the tilled land produced crops of wheat, rye, oats, corn and sugar beets which were from 6.8 to 52.7 per cent. greater for tilled than for plowed fields. The average increase was 21 per cent. Dr. Ruth, an agricultural authority, speaking of tests with potato crops, says:

"All the sections were manured alike, but in all cases 11 per cent. more potatoes were produced on the tilled sections than on the plowed ones, although the yield could not be increased on the plowed lands by increasing the amount of manure or fertilizer."

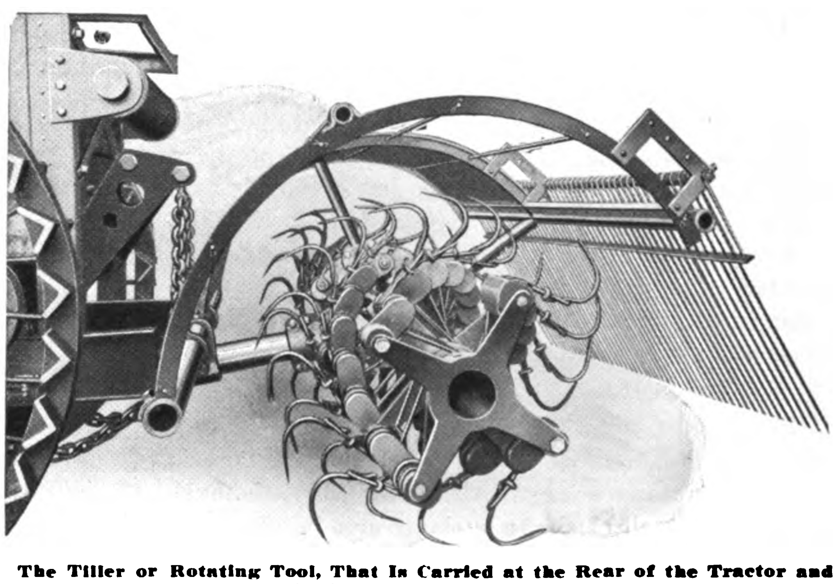
In addition to its rotary tiller the Allis-Chalmers Company is also the manufacturer of a farm tractor of the usual type known as the 10-18 tractor. It is for farms of average size and is adaptable to all the purposes for which power is required.

It has two drive wheels and one steering wheel, and a differential is provided so that the tractor can be easily steered to either side. The steering wheel is in line with one of the drive wheels and these wheels may therefore run in a furrow, steering the tractor automatically when plowing.

The clearance of the machine above the ground is 25 inches, to enable it to be used for cultivating. A pulley is provided and the whole power of the motor may be used for driving machinery, such as fodder shredders, wood saws or similar apparatus.

The motor is a two-cylinder horizontal opposed type which is in perfect balance. The engine is built for heavy duty work and comparatively slow operation. The cylinders are 5¼ inches bore by seven inches stroke. The speed is controlled by a centrifugal governor enclosed in a dust proof casing, so that it runs in oil. A force feed oil pump supplies oil to the cylinders and bearings. The bearings are all accessible and can be replaced or adjusted without removing the crankshaft.

The water cooling system is actuated by a centrifugal pump which forces the water through the cylinder jackets to the tubular radiator. A high-tension magneto is used for ignition, with batteries for starting. The clutch consists of friction shoes operating



The Tiller or Rotating Tool, That Is Carried at the Rear of the Tractor and Cuts the Soil Into Chips Like a Hoe.

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on the inside rim of the flywheel. It is readily adjustable for wear. The differential and all gears except the bull gear and pinion are enclosed in a dust proof case and run in oil. There is one speed ahead and one in reverse. The frame is a single steel casting that is exceptionally strong and rigid.

The drive wheels are 56 inches high, with 12-inch face, while the steering wheel is 32 inches in diameter and six inches wide. The drive wheels are provided with spuds or grouters. The speed of the machine is 2.33 miles an hour. Its belt horsepower is 18 and its draw bar pull 10 horsepower. It weighs 4800 pounds. The tractor has a 96-inch wheelbase, a width of 70 inches and is 144 inches long.

This machine is intended for use with plows, cultivators and all of the usual farm machinery.

THREE NEW APCO SPECIALTIES.

Three new Apco specialties have been placed in the market by the Auto Parts Company, Providence, R. I. They include two fan belt attachments and a spark and throttle lever lock. A lock secured the two hand control levers in a fully advanced position, preventing the use of the car by others than those intended. The device is simple and light, has a high-grade lock and can be placed in service in a few seconds.

The fan belt retainer is designed to prevent the belt leaving the pulley when loose or not properly adjusted. It is attached to a crank case bolt and is adjusted by a set screw. It will require no attention after it has been installed.

The automatic fan belt adjuster automatically maintains the proper tension without any attention after the device is fitted. This feature is obtained by an imported spring which is secured at one end of a stud and on a hook. It prevents rattling and can be installed in a few minutes.

ALLIS-CHALMERS DIVIDENDS.

The Allis-Chalmers Manufacturing Company has declared a dividend of 1½ per cent. on its preferred stock for the quarter ending Dec. 31, 1915, and an additional dividend of 1½ per cent. of accrued dividends on the cumulative preferred stock which had not been met when due. These will be the first dividends paid by the company since it was organized in March, 1913, as the successor of the Allis-Chalmers Company. Before these dividends were paid 14 per cent. had accrued on the stock. Capitalization of $16,550,000 is authorized, of which $15,849,500 is outstanding.

President George A. Kissel of the Kissel Motor Car Company believes that the educational stage in the use of motor trucks has passed and that it is much easier now to sell trucks to business men because they know what trucks will do and they also know they need them.

BIG RECORD BY FEDERAL TRUCK.

A total of 136,800 pounds of sand was hauled in slightly less than five hours at Atlantic City, Oct. 14, 1915, by a 3½-ton Federal dump truck. The work was closely analized by means of a tape recorder on the truck, which was checked against the cost figures for the work.

The complete analysis for the work follows:

	Hrs.	Min.
Work Done:		
Material hauled		Sand
Loads		18
Total number of stops		37
Total weight of loads in pounds		136,800
Distribution of Time:	Hrs.	Min.
Loading time	1	00
Unloading time, including delays on job	0	57
Miscellaneous standing time	0	02
Total standing time	1	59
Running time	2	50
Total of standing and running time	4	49
Average loading time	0	03.3
Average unloading time	0	03.1
Mileage and Speed:		
Miles travelled		28.30
Average speed in miles per hour		10.00
Average hauling distance		.786
Gasoline Consumption:		
Gallons of gasoline used		8.00
Miles travelled per gallon of gasoline		3.56
Cost:		
Total cost for work*		5.69
Cost per mile travelled		.201
Cost per ton delivered		.083

*This figure includes every item chargeable to motor truck hauling, such as interest on investment, insurance, taxes, driver's wages, gasoline and oil and supplies, allowance for repairs and maintenance, depreciation and tires, and is based on authentic and actual average figures as reported by users operating in various parts of this country.

CANADIAN LUMBERMEN LIKE TRUCKS.

The economy of the truck in hauling lumber, especially on the longer trips, was a principal subject with several lumber dealers at a recent meeting of the Lumbermen's Section of the Toronto, Canada, Board of Trade. L. F. Strickland, who has used trucks successfully, declared that speed of operation and constant movement were essential to truck economy. He said an additional advantage was that in figuring horse expense it was necessary to take into account 365 days of the year, while with trucks expenses could be figured on a basis of about 318 days.

LINK JOINS WILSON TRUCK.

Vincent Link, formerly chief engineer of the Universal Truck Company, and previously a truck engineer for the Packard Motor Car Company, has been appointed engineer for the J. C. Wilson Company. He is to design a two-ton truck. G. E. Porter, formerly engineer for the company, has identified himself with a truck company in a town near Detroit which is to produce a ¾-ton truck.

The New York Rotary Club has invited Rotarians from all over the country to join them at dinner in the Hotel Imperial, Tuesday, Jan. 4, when speakers chosen from the motor industry will address the company.

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METZ LIGHT DELIVERY WAGONS IN FIVE TYPES.

THE Metz Company, Waltham, Mass., which has for years built pleasure cars, chiefly notable for the use in them of a friction power disc transmission system, is now meeting a demand for light delivery wagons by equipping touring car chassis with five types of bodies. All of these chassis are the same, but the equipment and the styles of bodies differ. The prices range from $475 to $600.

The most interesting feature of the Metz chassis is the friction power transmission system, which serves both as clutch and a change gear shift. The motor turns a propeller shaft on the end of which is a large steel disc. Set against this disc so that it can be moved into contact with it by the control lever is the rim of a wheel that is faced with fiber that has a very high co-efficient of friction. The wheel is mounted on a jack shaft.

When this wheel is moved by the control lever into contact with the disc it is turned by friction and it turns the jack-shaft on which it is mounted. The speed can be controlled by moving the wheel with the friction grip from side to side. If it is near the centre the disc turns several times to one turn by the jack shaft. If it is moved near the edge power is transmitted practically by direct drive.

Single Silent Chain Drive.

In older types of chassis two exposed chains were used to convey the power from the jack shaft to the rear axle. But in the later machines the drive is by a single silent chain which runs in oil. This is set at the left side and outside of the car frame at the end of the jack shaft.

The motor is a four-cylinder, vertical, water cooled design, which is rated at 25 horsepower by the A. L. A. M. formula. The cylinders are cast en bloc. The crankshaft is supported on three main bearings. Inlet and exhaust valves are on the right sides of the cylinders and are actuated by a camshaft which is carried inside of the crank case and is thoroughly lubricated.

The upper half of the crank case is carried on two main channel sections bolted to the main frame. The crankshaft bearings are held between the upper and the lower halves of the crank case. The bottom section is an oil well and is easily removed for inspection of the interior of the motor.

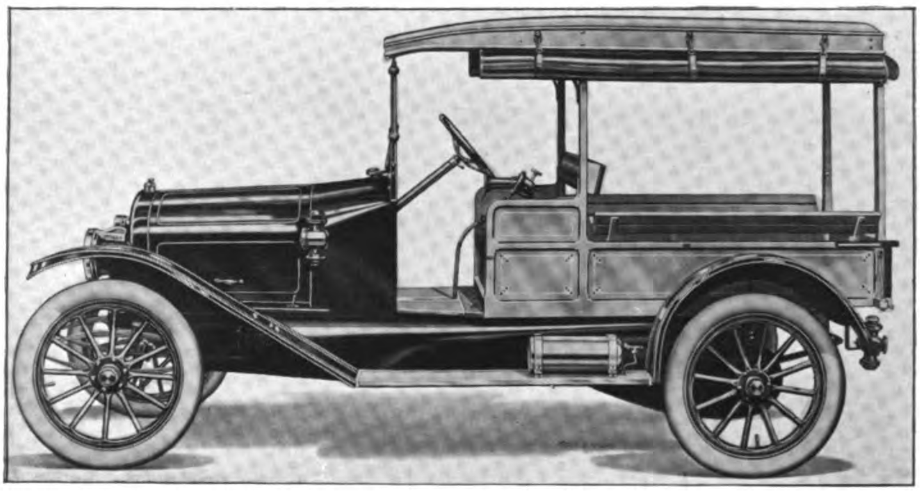
The carburetor is made by the American Watch Tool Company. It has a float feed and automatic regulation for all engine speeds. The gasoline tank is placed in the cowl and fuel is fed by gravity to the carburetor. Bosch high-tension magneto furnishes the ignition spark.

The constant level splash system keeps the engine lubricated. Oil enters the crank case through a breather pipe with a funnel attachment on the side of the motor. An oil pump distributes the oil to pockets directly beneath each connecting rod. Overflow arrangements return the oil to the reservoir.

Water is circulated through the motor and radiator by a thermo-syphon system. The electric starting and lighting system used on the delivery cars when it is desired is the well known Gray & Davis equipment.

Tubular Rear Axle.

The rear axle is a tubular self-contained type mounted on Hyatt roller bearings. The bearing housings are used also as supports for the body springs and are placed well out toward the wheels. Right and left hand members of the rear axle assembly are united through a spur differential to the driving sprocket.



Metz Friction-Driven Chassis Equipped With a Model C Express Body With Standing Top That May Be Enclosed by Curtains.

The wheelbase is 105 inches and the tread is 56 inches. Wire wheels 32 inches by 3½ inches, with 48 spokes are employed. Pneumatic tires are used on clincher rims. The tires are Goodrich, 32 by 3½ inches. .

Internal expanding and external contracting brakes operate on 14-inch drums lined with multibestos on the rear wheels. Both brakes are operated by foot pedals. The springs are full elliptic, of ample width and length.

Of the commercial cars on this chassis, model A is equipped with Prest-O-Lite tank, two gas headlights, two oil side lights and one oil tail lamp. The body is 54 inches long inside, 41½ inches wide and 10 inches deep, with six-inch flare boards. The price is $475. Model B is the same except that it has a Gray & Davis electrical light and starting system and the price is $525.

Model C is the same as the two preceding models

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except that it has a top over the body with side curtains that can be let down to completely protect it. With gas lights the price is $525, and with electric system it is $575.

Model E has an entirely enclosed panel body and is equipped with an electric starting and lighting system. The body is 54 inches long inside and 38 inches wide at the bottom, tapering to 42 inches. It is 49 inches from the floor to the ceiling in the centre. The door is 26 by 39 inches. The price is $600.

S. A. E. RECOMMENDS LICENSE PLATES.

The Standards Committee of the S. A. E. has been working on the problem of standard license plates for all the states. It has planned a plate of definite size and shape and is also designing standard plate carriers which will be urged for adoption in all the states. The advantages are expected to be greater legibility both day and night, easy mounting on the car and cheaper production of the plates, since they can all be made on the same machines. Every phase of the matter is being studied and the committee expects to produce a thoroughly satisfactory plate.

TRUCK GOVERNORS AND SAFETY FIRST.

The use of truck governors to prevent excessive speed and street accidents resulting from it has been urged by the Safety First Federation. C. R. Norton, truck sales manager of the Packard Motor Car Company, calls attention to the fact that Packard trucks have always been equipped with governors restricting the speed to 12 miles an hour. The governor, in connection with the efficient brakes used on the trucks, makes it possible to stop in a distance equal to the truck length.

MIAMI TRAILERS FOR DELIVERY.

Light, strong, rubber tired wagons for use as trailers with automobiles in all sorts of service are built by the Miami Automobile Trailer Company of Troy, O. Some of the uses for these trailers, as shown by photographs in a catalogue issued by the company, are hauling calves from farm to market, hauling additional baskets behind a motor laundry delivery and collection wagon, hauling trucks behind a taxi cab, hauling telephone repair material behind the repair man's car, hauling milk to the city, hauling a boat away on a fishing trip and hauling a piano into the country behind the salesman's automobile.

Charles M. White, Jr., formerly manager of the Detroit office of the Stromberg Motor Devices Company, and before that with the Detroit office of the Firestone Tire and Rubber Company, has become associated with the selling force of the spring department of the Detroit Steel Products Company.

294 KILLED, 6197 HURT.

Accidents on Massachusetts Highways Increase 37 Per Cent. in 1915.

The annual report of the Massachusetts State Highway Commission for the fiscal year ending Nov. 30, 1915, show that 294 persons were killed and 6197 injured in 10,904 automobile accidents which happened in the state during the year. This is an increase of about 37 per cent. over the number of accidents in 1914.

During the same period motor vehicles increased 33 per cent. in number, so the accidents are shown to be increasing more rapidly than are the cars. In 1914 229 persons were killed in motor accidents and 4010 injured.

Of the number killed this year more than half were pedestrians. The figures show 188 pedestrians, 84 occupants of motor cars, 15 motorcycle riders, three bicycle riders and four occupants of carriages were killed. The following table shows the comparisons of killed, and injured:

	Killed		Injured	
	1914	1915	1914	1915
Pedestrians	150	188	2303	3110
Occupants of autos	56	84	879	1521
Motorcycle riders	18	15	337	636
Bicycle riders	3	3	256	497
Occupants of carriages	2	4	217	421
Street car passengers	0	0	18	12
Totals	229	294	4010	6197

Of the 10,904 accidents, 3848 were caused by the collision of automobiles and 3282 by an automobile striking a pedestrian. Most of the accidents happened on the streets of cities in the day time and very few on country roads at night. The following analysis gives the facts:

	1914	1915
Motor vehicle vs. pedestrians	2393	3282
Motor vehicle vs motor vehicle	2521	3843
Motor vehicle vs. carriages, etc	1092	1174
Motor vehicle vs. bicycle	348	532
Motor vehicle vs. trolley cars	498	602
Motor vehicle vs. pole, curb, etc	777	1056
Motor vehicle vs. trains	22	30
Motor vehicle vs. horse, dog, etc	310	369
Motor vehicle vs. miscellaneous	..	16
Totals	7961	10,904
Accidents in daytime	6009	8189
Accidents after dark	1952	2717
Accidents on country roads	1942	1773
Accidents on city or town streets	6019	9133

Owing to a shortage in many of the materials that are required for tires and of high prices generally in the material market, it is probable that an increase in the price of tires will be made after the first of the year. At present the various tire companies are all hesitating and are disinclined to be the first to take the step.

Scraps of steel containing tungsten and worn out tools are now being saved by all the large companies to be smelted down and used over again. The acute shortage in tungsten is the chief reason for this economy.

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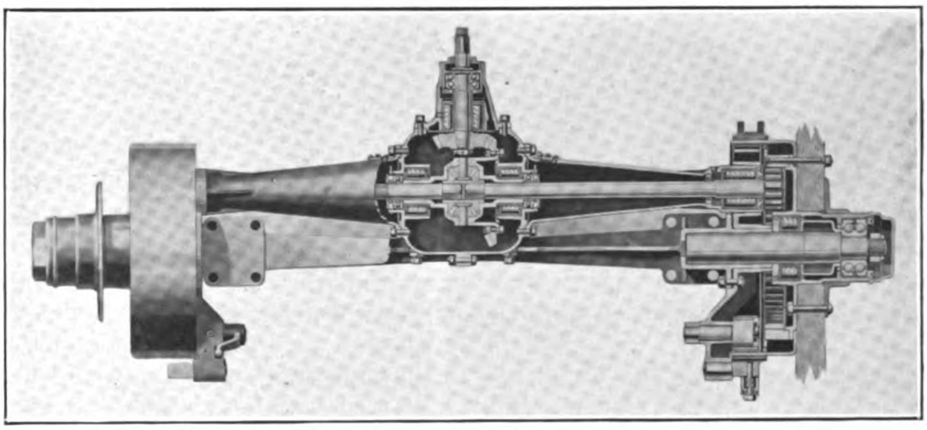
CELFOR INTERNAL GEAR DRIVEN REAR AXLES.

Are Built to Standard Design for Trucks from 1500 Pounds to Five Tons Capacity, with a Special Ton Type for Either Gasoline or Electric Machines.

POWER transmission is a detail of motor vehicle construction that is now receiving the attention from the manufacturers of the industry that its importance deserves. When builders of automobile vehicles first turned to the production of machines for carrying freight there was general belief that engines of large power were necessary, which was an assumption gained from experience with pleasure cars of high speed. In fact, there was a very widely prevailing impression obtaining that power more than anything else was required, and that a chassis that would serve for a car could be converted to haulage purposes by merely installing a different body.

There were, of course, some men who studied automobile construction with the purpose of learning what types or forms would afford the best mechanical results, and among them were those who realized that strength was more necessary than speed, and that a comparatively small engine with an efficient power transmission system would be far more serviceable and endure much longer in normal operating conditions than a large motor with a method of drive that was less developed.



A Celfor Two-Ton Capacity Internal Gear Driven Rear Axle with Section Removed to Show the General Construction.

With better knowledge derived from observation and experiment, automobile engineers began to devise protection of the moving parts of the engines from the accumulation of abrasive substances—generally deposits of dust and dirt from the roads. No matter what the provisions made for lubrication, unless the lubricant was enclosed the dust reaching it would be accumulated and in a comparatively short time the oil or grease would be transformed into an abrasive compound that would be the endurance of the moving and contacting surfaces.

Need of Enclosing Wearing Parts.

In fact, with a comparatively small volume of lubricant, effectively protected against dust, a machine can be operated constantly for a long time without perceptible wear. The best results can be obtained by the frequent application of small quantities of oil or grease, but in normal service practical purposes can be well served by using considerable quantities that may be replenished at varying intervals. But while this principle could be easily adapted with reference to some portions of the vehicle, many difficulties were met with in endeavors to enclose and adequately lubricate all moving parts of the chassis.

Reduction gearing is absolutely necessary in two places in the power transmission system—the one to obtain the different ratios of speed when starting and when ascending grades, or hauling a heavy load, and the other to reduce the speed of the vehicle to what may be regarded as a serviceable maximum, for power is obtained by engine velocity. Normally without a gearset a loaded vehicle could not be started, because were the engine turning slow it would not have sufficient power to move from anchorage. If the engine were turning fast enough to create power adequate for ordinary requirements when applied the results would be destructive.

For this reason there is a gearset to obtain different ratios of speed of the traction wheels from any constant movement of the engine, and there must also be a constant reduction of the road wheels as compared with the engine shaft. The first method of reduction is by meshing gears of different sizes as required by the conditions of operation for forward movement of the vehicle, and to reverse the movement of the traction wheels so that the machine may be driven backward when necessary. This is what is known as the transmission gearset. The second reduction is by meshing a pinion at the end of the driving shaft with a gear that drives the axle shafts, or by engaging a worm shaft with a gear wheel that drives the axle shafts.

With the chain driven machine, so-called, the jackshaft is constructed exactly as is a rear axle of the semi, three-quarters or full-floating type, but instead of this carrying the load, it is suspended from the chassis frame, and the chains extend from sprockets at the ends of the driving shafts to sprockets on the rear wheels. With this construction there are three reductions. That which is variable, that at the jackshaft,

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and again from the variance of the sizes of the jackshaft and wheel sprockets.

Bevel Gear Drive Is Efficient.

So far as the transmission of power is concerned, the bevel gear is efficient. No one has ever questioned the endurance or the satisfactory operation of this construction. But to obtain the reduction of the gears at the rear axle necessary for the slow speed of a truck means so large a master gear that its size is practically prohibitive.

By the statement that the size of such a gear is prohibitive is meant that to obtain such reduction and house the gearset in a shell or case would necessarily require heavy construction, and sufficient road clearance could only be obtained by increasing the diameter of the wheels, which in turn would raise the centre of gravity and lessen the stability of the machine when loaded. This lack of stability would be serious when the vehicle is driven at speed or on uneven road surfaces or when the load is not equally distributed.

Chain Drive a Simple Solution.

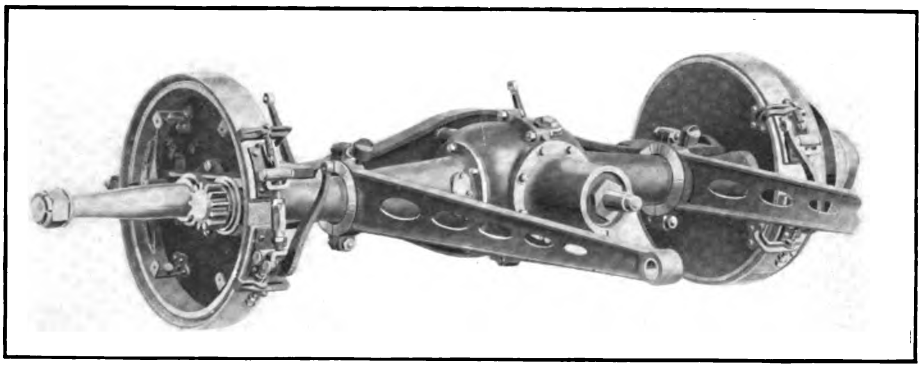
The simplest solution of the problem of rear axle gear reduction was by the use of the jackshaft suspended from the chassis frame and the dead axle, which carried the load, the power being transmitted by chains from the sprockets. This afforded the required protection for the jackshaft and the gearset and a very large variation of constant reduction at the sprockets and the jackshaft gearset, and were protection of the chains practical, there would be no need of further development. The chains must be lubricated and abrasives of every form will adhere to lubricated surfaces and become very destructive. Even dust will cause extreme wear in very brief time. Endeavors were made to enclose the chains in cases, but these were heavy, were often damaged through contact with road obstructions, and while the chains were not so much worn when these were used, adjustments were made with great difficulty and at considerable cost.

One result with chains is the "back lash" that obtains with varying degrees as the chains and sprockets wear. If too tight the chains will absorb power unnecessarily, and if loose the movement of the jackshaft before the wheels are moved when starting, or the action of the brakes when stopping, will cause excessive stresses upon the tires. The proportion of the weight of the truck that is carried on the rear axle will vary from 60 to 75 per cent., and the percentage of the weight of the load carried by this axle will range from 70 to 95 per cent. Besides the load and the driving and braking stresses upon the tires, there is the effect of "back lash" when the chains are not adjusted, and these in the aggregate are undoubtedly destructive.

Development of the Internal Gears.

The experience with chains and belt transmission of power led to the development of other systems, that known as the internal gear being first constructed in Germany about 15 years ago, and the worm and worm wheel that was perfected in England by several of the builders of pleasure cars and trucks.

The internal gear system of power transmission has been used longer in this country than any other form of drive, although with trucks and wagons only, and of course to a very limited extent until within the past five years, since when it has been manufactured by one concern. This drive is now produced commercially by several companies, among which is the Celfor Tool Company of Buchanan, Mich., which is building rear axles for trucks and wagons of from 1500 pounds to five tons capacity.



Celfor Three-Ton Capacity Internal Gear Driven Rear Axle with Radius Rods Fitted—The Five-Ton Axle Is the Same Type.

The internal gear drive that has been developed abroad, especially in Germany, and which is known as the Mercedes type, has what is practically a jackshaft that is mounted ahead of the solid rear axle, the radius rods being extended back of the axle. The radius rods are so designed that they may be rotated on the axle, and the rear ends of these rods support the brake shafts for one set of brakes. The jackshaft is carried forward of the axle by the radius rods, which also carry the flanges that enclose the internal gears and the expanding brake shoes, and while the rear axle may move because of spring deflexion or reflexion, there will be no change in the relation of the driving pinions of the jackshaft with reference to the internal gears attached to the rear wheels.

There is another type of internal gear driven axle in which the jackshaft is carried on the chassis frame, where it has the protection of the springs, and which is directly above the load carrying axle, universal joints being above the wheel pivots when used for front wheel drive. This is the Latil type of construction and is extensively used in France. These two designs are referred to for the purpose of establishing that internal drive jackshafts may be either above, forward or back of the axle that carries the load, and there appears to be no material difference so far as efficiency is concerned, and the only question that might be raised is whether one has any advantage as compared with another with regard to accessibility.

The main purpose with all designers of internal gear driven axles has been to obtain the lightest weight

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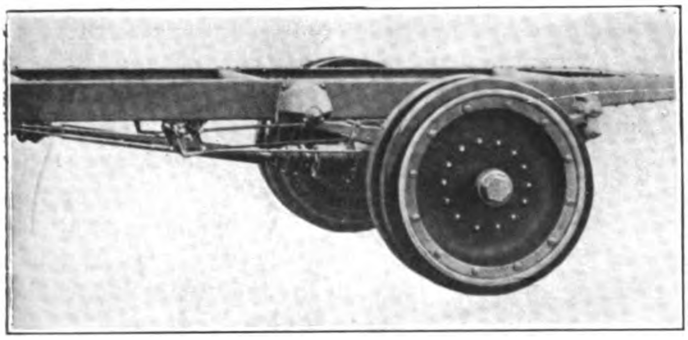


A Celfor Internal Gear Driven Rear Axle Fitted to a Three-Ton Truck, Showing Position of the Drive Shaft Without Load.

that was practical with the required strength, and without exception a much lighter construction is possible than with any other form of axle. In this connection the statement may be made that taking any other design in which the jackshaft is combined with the axle the internal gear types will weigh from a third to a half less. This is a material factor when one considers that the engine must supply power to move this axle, and excessive or unnecessary weight must be carried constantly, and besides this there is the added tire wear. One of the claims made by engineers who have engaged in investigation of the results of vehicle wear on tires is that one pound of unsprung weight is as destructive as 10 pounds of sprung weight. That is, there is that difference when the weight is resting directly upon the tire or there is a spring between it and the greater part of the load.

Considering this factor, the reduction of the weight of the axle is of much importance from the viewpoint of tire economy, and there is another possibility for increasing the life of tires because of the greatly lessened stresses upon them when starting or stopping. The power is applied to the internal ring gears through the pinions on the ends of the jackshaft, and this affords a far greater leverage. The application of power is always the same. By this is meant that the pinion meshes with the internal ring gear at a point removed from the centre of the wheel, and the movement can be made easier and slower. This may be likened to applying power to the hub and to the rim of a wheel, much less energy being required to move it at the rim than at the hub.

Higher Speed of the Shafts and Gears.

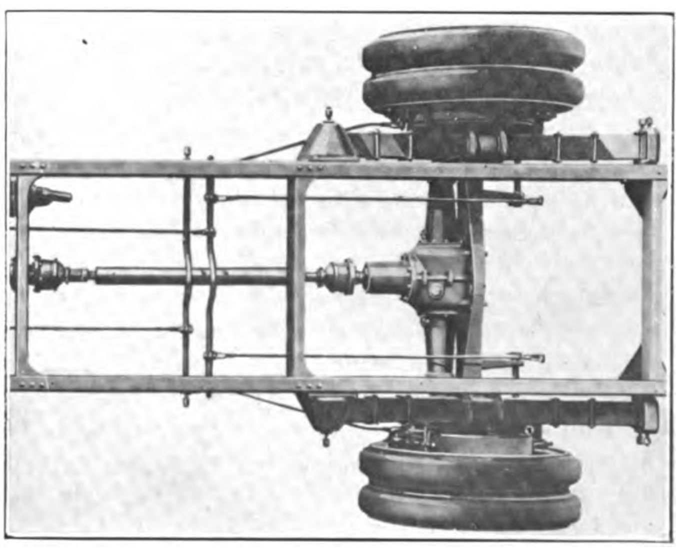
Because of the greater reduction at the internal ring gear there is less reduction at the differential, which allows the use of smaller and higher speed shafts and gears, this necessarily reducing the weight without sacrificing power. The load is carried on a solid axle, which may be fitted with any form of bearings that will best serve—either roller or annular ball types—and the axle beam itself may be formed to best resist the weight which it will have to endure. This has led to the very general adoption of an I beam, this having the most strength for the cross section necessary, and which is very generally approved by engineers.

The Celfor design of internal gear axle differs somewhat from other types in that the jackshaft is mounted forward of the I beam, to which it is secured, and on the housing in the larger sizes is mounted the rear ends of the radius rods, these being so designed that they will rotate on the housing to compensate for the changed angles of the rods when the springs are deflected by the load upon the chassis platform. The I beam is widened at the centre and through it is an oval shaped opening, into which the back of the differential housing of the jackshaft is seated. The width and depth of the I beam varies according to the capacity of the axle, and there are cross webs at the tops and bottoms of the beam. The vertical web of the solid axle is thinnest in the centre and this affords what may be likened to a truss construction in that the form has the greatest resistance to a load upon it. This I beam is a drop forging that is struck and shaped in dies, with the spring seats integral.

Nickel Steel Wheel Spindles.

The ends of the I beam are solid and these are machined with sockets into the ends that carry wheel spindles that are made of 3½ per cent. nickel steel. These spindles are large in size and are ample for the carrying of any weight that may be placed on the axle. There are vertical flanges at either side of the axle web below the spring seats which serve as anchorages for the spiders or flanges that form the cover of the internal gear and the internal brake. These spiders are bolted to the flanges.

The jackshaft housing is built of two sections that are belled to the centre from the ends, and which are bolted to a central section that is divided vertically and is secured by a series of bolts. The ends of the housing are retained in the brake spiders in sockets, and these ends each carry the roller bearings for the outer ends of the axle shafts. There is an opening in the front of the housing that is closed with a plate retained by bolts, and this carries the extension in which is mounted the double-row ball thrust bearing and the roller bearing for the pinion shaft. The differential assembly is comparatively small and it is mounted on



Top View of Rear End of a Three-Ton Truck Equipped with a Celfor Internal Gear Drive Rear Axle.

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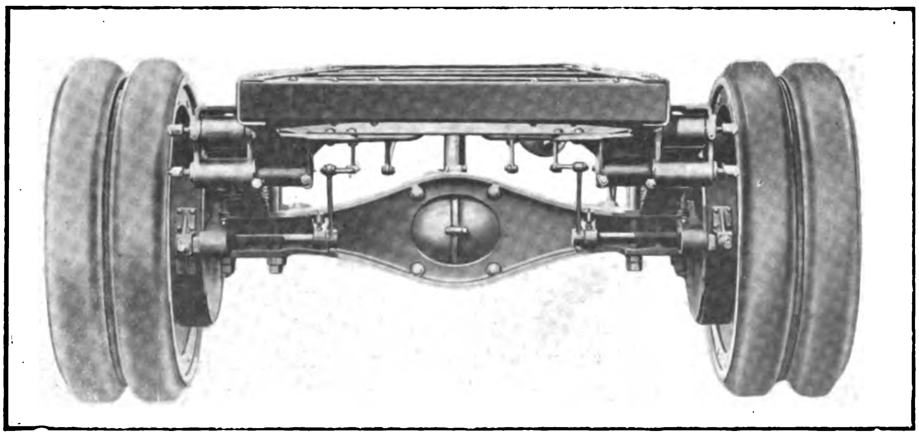
single row ball thrust and roller bearings that are carried in webs bolted to the housing. Because of the reduction at the internal ring gears and pinions, the bevel gear is relatively small and the driving shaft pinion is large, this making for higher speed than with the bevel gear driven, semi or full-floating axle. The central section or the differential housing of the jackshaft shell is bolted to the I beam by four bolts that rigidly secure it.

The pinions at the ends of the jackshaft are keyed to the shafts and these mesh with the teeth of the ring gear. The hubs of the wheels are formed with flanges that carry shoulders for the seats of the internal ring gears, and there is a recess under each flange edge that serves as a seat for the brake drums. When the wheels are assembled the spokes and the outer hub flanges are secured by bolts that pass through the flanges and the spokes, securely retaining the brake drums. This method of construction makes the wheels solid assemblies that are fitted with roller inner bearings and double-row annular ball thrust bearings, which are separated by an annular ring surrounding the axle spindle. The wheels are secured on the axle spindles by washers and lock nuts. The hubs are covered with tightly fitting hub caps.



Rear View of a Celfor Internal Gear Driven Rear Axle in a Three-Ton Truck, Displaying the Design of the Load Carrying Drop Forged I Beam.

Spiders Carry the Brake Shafts.

The spiders that form the covers for the internal gear cases and brake drums have heavily webbed offsets at the rear, which serve as supports for the camshafts for the internal expanding brake shoes, and which also carry the anchorage studs for the external contracting brake bands. These brake shoes and bands are faced with anti-friction material that contact with the interiors and the exteriors of the steel drums. The drum surfaces are large and the brakes are ample for any condition of operating.

The construction is extremely simple and the work is done with great care to insure accuracy and close fitting. There is no end thrust whatever upon the axle driving shafts and these are comparatively short and have very large bearings.

The very general description given is of the standard type axles, which are all similar to those shown in the illustrations, but differ only in the sizes of the parts and in the materials used. The one and two-ton size axles are designed for taking the drive and the torque through the springs, this being the well known Hotchkiss type of construction, but the larger sizes, three and five tons capacity, are built with radius rod and torque arm connections. One of the illustrations shows the two-ton size without radius rods, and another the three-ton size with the radius rod connected.

Strong Claims for High Efficiency.

Strong claims are made by the manufacturer for the simplicity and endurance of these axles, these including lightness in weight, extreme rigidity, quiet operation and the moderate cost as compared with other forms of enclosed axles. Statement is made as well that the factor of safety is much more than would be required in any condition of operation despite the comparatively light weight. In all the sizes of axles the internal ring gears are alloy steel drop forgings in which the teeth are very carefully cut, and these gears are case hardened, so that the service life ought to be 100,000 miles or more. The gear reduction at the wheels is $4\frac{1}{4}$:1. All of the bearings are non-adjustable, there being roller bearings where radial loads only are carried. All axles are built so that the parts are interchangeable from the one side or end to the other, there being no rights or lefts with reference to any part. This very much simplifies repairs.

The axles that the company produces in these standard types are from 1500 pounds to five tons capacity, but in addition there is a special one-ton axle designed for electric vehicles, either pleasure cars or for service purposes. This axle is said to be an unusually well designed and finished product. It is fitted with annular ball bearings throughout and all the castings of the jackshaft housing are aluminum, this metal being used to reduce weight. The bevel gears throughout are spiral cut, so that the axle may be used in a machine equipped with a very high speed motor and still be very quiet of operation.

Statement is made that the Celfor Tool Company, which has a finely equipped plant with much recently installed machinery specially obtained for the manufacture of these axles, is now increasing its factory facilities to triple its production, so that it may meet the increasing demand for internal gear driven axles. The company is hurrying this work to completion that it may be able to serve a very large part of the industry that is desirous of using this equipment.

C. R. Green, receiver of the Speedwell Motor Car Company of Dayton, O., has rendered his final report and has been discharged.

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WOMEN GIVE WHITE ARMY FIELD WAGON.

The resources of those who are moved by humanity to afford relief to those who are suffering through the European war are by no means equal to the desire to benefit those in need, and the endeavors of organizations that are systematically engaged in this great charitable work appear pitifully inadequate when the devastation of property and the injury and sickness of millions of men, women and children are known. The people of the United States have given freely and continuously to assist those who are in want, and without this aid the consequences would be even more serious and acute.

How far-reaching is this belief, how much benefit it does, none of those who contribute knows, but there is no doubt that unless it were extended war would be infinitely more horrifying than it now is. In every part of the country, in practically every city and town, there are those who work unceasingly for charity. There is in Philadelphia a number of well known women who have organized as the French Relief Committee to afford direct and indirect assistance to hospital and charitable organizations actively engaged in the war zones occupied by the French armies.

One of the results of this committee's endeavors is shown in the accompanying illustration of an army field wagon on a White chassis, which was purchased by E. T. Stotesbury, and which has been sent to France. Before the wagon was shipped it was inspected by the members of the committee at the Philadelphia branch of the White Company and accepted formally. In the illustration the members of the committee shown are, from left to right: Mrs. Cyrus K. Curtis, Mrs. Charles M. Lea, Mrs. E. T. Stotesbury, Mrs. Cornelius Stevenson, Mrs. Harold Ellis Yarnall, Mrs. Arthur Hutchinson, Mrs. R. G. Ervin, Miss Mary Montgomery and Mrs. A. C. Munoz.

A White Truck Chassis Equipped as an Army Field Wagon, Purchased by the French Relief Committee, an Organization of Prominent Philadelphia Women.

Since the Carranza government has succeeded in restoring peace to the Tampico oil fields, great activity has developed there. Drillers and other oil men from the United States have been pouring in in great numbers and thousands of new wells are to be started. Very large extensions to the storage tanks in the port are also projected.

The Detroit Auto Parts Company is to make parts for motor vehicles on a large scale. It has been organized with a capital of $50,000. Joseph, Eugene and Leo Siegel of the American Lady Corset Company are the incorporators of the company.

FARM TRACTORS IN ENGLAND.

Reduction of Animals and Labor Forces Farmers to Machines.

Special circumstances brought about in England by the war, which has greatly cut down the available supply of horses and of labor at a time when the demand for food to provision the armies and feed the civil population is especially severe, have given the movement toward the use of mechanical traction on the farms a strong impetus.

The situation at present makes it possible to purchase mechanical equipment for farm work for about the same capital outlay that is required for horses to do the same work and the actual cost of plowing is now from three to five shillings an acre as compared to eight to 10 shillings—the horse costs before the war. Horse costs have, of course, risen considerably and the higher prices brought by food stuffs makes the success of tractor operation even more sure.

There is probably no more conservative class in the western world than the English farmers and land owners, but these exceptional circumstances are shaking even their great conservatism and there seems to be a real possibility that the war will succeed in revolutionizing English farming as rapidly as the natural forces of progress are accomplishing that result in the United States.

In addition to the tractor for farm work, the motor wagon or truck for hauling on the roads promises to have a lively development. Farms there are generally so small that there is no great likelihood that the average farmer will be able to employ such vehicles exclusively for his own work, but co-operative trucking or the hired truck service of a business conducted exclusively for that purpose is sure to develop.

The Ford Motor Company's production and shipments since Aug. 1 is 66 2/3 per cent. more cars than were turned out in the same period last year. The company is said to have 105,000 orders for immediate delivery upon its books at present.

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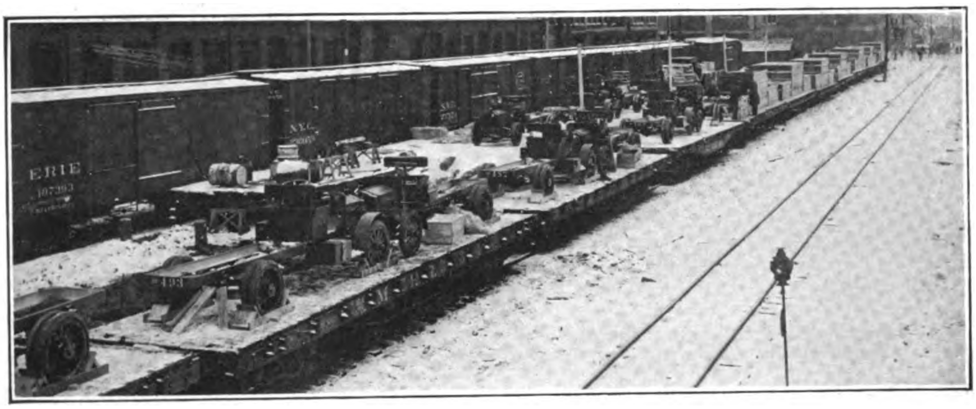
CAR FAMINE KEENLY FELT.

Delivery of Rush Orders from Factories a Big Problem for Shippers.

Throughout the country the demand for freight cars of all kinds exceeds the available supply by a percentage that is probably fixed by the need of the shipper, and the railroads are so congested that no definite time can be given for delivery. With a call for three cars or more to every one in service, with lack of locomotives to haul the trains, with the sidings and yards filled with loaded cars, with the freight house crowded to such extent there is no room for the handlers to work advantageously, if at all, with the shippers and consignees using every endeavor and influence to keep the freight moving in and out of the hands of the transportation companies, with manufacturers resorting to express shipments of large proportions to avoid the delays of freight transportation, every business man has a condition to meet that is regarded as unparalleled in the history of the country.

The truck manufacturers who have large orders to deliver, while they have their troubles in obtaining materials, must neglect nothing that will serve the interests of their customers. Getting cars is not only a problem, but getting them handled after they are loaded is nearly as difficult an undertaking. The resourcefulness of some of the shippers, born of long experience, is often times their salvation. An example of conditions that are met with is shown in the accompanying illustration, which was photographed at the factory of the Packard Motor Car Company, Detroit, Mich.



Because of a Famine of Automobile Cars Packard Trucks are Shipped on Flat Cars, Sheltered by Frames and Canopies of Water Proof Canvas.

The trucks are ordinarily shipped in special cars, having end doors to afford ease in handling, which will thoroughly protect the contents. During the present car famine these cannot be obtained, nor, in fact, any kind of an enclosed car in which a truck can be transported. The traffic manager has turned to flat cars, such as are used for lumber. On these two trucks are drawn with the front ends in the centre of the car. Then the machines are blocked and anchored with heavy timber specially cut to serve the requirements, because cars are not always gently used. To protect them frames are built around the trucks, which were covered with a water proofed canvas. In this manner hundreds of trucks have been shipped. The loading platform at the factory will take 16 flat cars at a time, or a very fair sized train.

MANY INTERNAL GEAR TRUCKS.

The production of motor trucks in the United States from Sept. 1, 1915, to Sept. 1, 1916, is said by officials of the National Automobile Chamber of Commerce to have been 37,000. This year the output will be considerably larger. Already contracts have been signed by truck makers for 15,000 internal gear drive rear axles. A number of additional large contracts are to be made the first of the year. These facts indicate that a goodly proportion of next year's trucks will be equipped with internal gear drive axles.

PARRY COMPANY BUILDING BODIES.

In a large factory at Indianapolis, Ind., that has been given over to the manufacture of horse drawn vehicles for a third of a century, the Parry Manufacturing Company is developing specialties for the motor industry trade that can be made by its men and equipment. It will continue horse drawn vehicles as its main product but it has developed special bodies for the Ford chassis and it contemplates making large contracts for commerical bodies for other cars. The company is also building two-wheeled and four-wheeled trailers. The four-wheeled trailer is coupled by a convenient adaptation of the Bradley coupler, which gives a straight pull at either end of the axle so that the trailer tracks perfectly with the car in front. These bodies are offered to dealers. The products include tops and in all about 12 specialties.

HAS $6,000,000 TRUCK ORDER.

The Blair Motor Truck Company, Newark, O., has been reorganized and $250,000 in stock offered for sale has been heavily over-subscribed. The company is said to have a single order for trucks for European delivery which will keep its present facilities busy for five years and will amount to $6,000,000.

The carriage tire department and the fire truck tire department of the Goodyear Tire and Rubber Company have been combined under the management of F. H. Sawyer.

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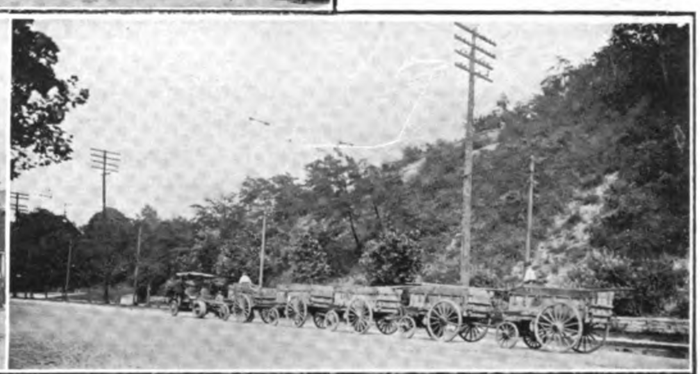
TRACTORS AND TRAILERS IN MUNICIPAL SERVICE

Large Loads Carried in Trains or Single Bodies in Cincinnati, O., and Springfield, Mass., Demonstrates the Value of City Equipment of Large Capacity.

ECONOMICAL reasons dictate that the loads carried by a motor truck ought not to exceed the rating given by the manufacturer, who has absolute knowledge of what the machine is designed for and its construction. The builder is quite certain to lay claim to all the capacity that the vehicle should be rated, and there is very good reason to believe that the speed limitation is set as high as it should be driven on the average streets and highways.

From a practical viewpoint a truck should not be overloaded and it ought not be driven faster than the limit stated by the manufacturer. Conceding these two statements as being reasonable and sufficient, another aspect must be considered. The fact that a machine should be kept moving as much of the time and as near the maximum speed as is possible is evident enough to those who have no definite knowledge of transportation economy. There are those who believe that by overloading and by fast driving they are regaining or "making" up the time that may be lost through conditions that they may or may not be able to control, and this class may be said to include a very large proportion of those who own and operate power trucks.



Testing a Tractor and Trailer Train at Cincinnati: At Left, Descending Gilbert Hill with a Load of 19¼ Tons; at Right, Climbing an Ascent 7000 Feet Long with Five Loaded Trailers; Above, Making the Turn Without a Stop.

The larger the load the greater the economy, provided that the freight is not excessive, is a well founded theory. If the load is limited by the capacity rating the only other possibility with the machine is to increase the speed, and this, too, is limited. But there are those who assume if the use they make of a truck is destructive they may in some manner evade their own responsibilities and by claiming defects or assurances obtain repairs or restoration without cost, or at least secure a reduction of charges legitimately made against them.

Because their requirements are not well judged when purchasing, because conditions changed, and for reasons that might be developed by service, many have found that increased loads are desirable, and the desire for general economy of haulage has impelled many owners to study the possibilities of greater load capacity with the original equipment. This has led to the investigation of the use of trucks and tractors with semi-trailers and trailers.

Vague Knowledge of Trailer Economy.

The actual knowledge of facts relative to operating costs of trailers with trucks or tractors is surprisingly vague. This is due to the very limited use of this type of vehicle and to lack of experience with them generally. The operating cost of motor trucks is not often known, there being but a very small percentage of owners who maintain accurate accounting systems, but those who keep such records feel that they are amply justified by the exact data that makes possible the development of economies that would not otherwise be obtainable. Even with the thousands of trucks and power wagons in service, but little of the information obtained by the owners is available for the sales departments of the manufacturers. As a rule what is utilized does not cover long periods, and it is by no means as sufficiently detailed as might be desired.

In the development of trailer wagons some interesting data has been accumulated by one manufacturer, but this was not extended over any considerable length of time and economy was not so much the purpose sought as was means of control. Most of the builders

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of trailers have found turning and backing and braking three conditions that could not well be met without specially adapted equipment, and the production of this has necessitated differing experiments. Some concerns now build tractors and others build trailers, but there is no manufacturer in the industry that has yet begun the production of both types of vehicles.

Value of Trials with Economy Standards.

Possibly if the builders of tractors were more numerous, or the machines and trailers were built by the same concerns, there would be more definite facts resulting from tests and experiments, but while there are some tractors in service and several companies are building trailers, each has conducted its experimental and development work separately. The European knowledge of tractor and trailer value as compared with other vehicles is much more comprehensive than that available in this country, and that is largely due to the competitions and trials which were organized and carried out by the army officials of the principal countries.

In France and Germany these trials were exceedingly thorough and were for considerable periods for events of this character, and they were participated in by the manufacturers with different types of machines. These were driven extended mileage and over average highways, and different fuels were used, and the records of each machine were carefully checked and compared with reference to each class of work. Both trucks and tractors were used in conditions which as nearly as possible correspond with what might be expected in army service and the work was necessarily to high standards of efficiency.

Private Trials in America.

In America the trials made with tractors have generally been what might be termed heavy hauls for comparatively short distances, these being arranged to meet conditions in which horses or trucks could not be used to good advantage. The work done, however, has been as a rule the haulage of much heavier loads than were hauled in the trials in Europe, and on grades that well demonstrated the power of the machines. During the past few months demonstrating hauls have been made with Knox tractors in different sections of the country, these being with both semi-trailers and trailers, with special built wagons and with equipment and wagons or carts coupled with the most convenient means and without much regard for the economical possibilities.

There is no doubt whatever that with trailers constructed to have both endurance and capacity, built to be hauled on the highways at speeds that can be made with tractors, and equipped with satisfactory means for control, both with reference to braking and turning, much greater economy would obtain than with a series of wagons secured together and hauled with the main object of learning haulage power capacity.

Work Done in Municipal Service.

These statements are made because of the very obvious absence of operating cost figures in what data will be included in this article, which will deal to a considerable extent with the work of two of these Knox tractors. One of these trials is especially interesting because it was a demonstration of a municipality, and this gave it a character that had not obtained with others previously made, and the other is more a statement of work done by a tractor that is owned by the city of Springfield, Mass. Since the first test was made the city, Cincinnati, O., has also purchased a machine, the practicality of the service and its very evident economy as compared with other forms of haulage convincing the municipal officials of the desirability of buying.

Cincinnati is located on the north bank of the Ohio river, which is a stream of considerable proportions at that point, and the city is built from what is the recognized water front on the hills for several miles back. The rise is so steep in places that direct haulage of loads is not attempted on some of the streets, and what are known as "inclined planes" afford access by vehicle to some of the sections of the city. On the "inclined planes" the vehicles are hauled to the top and lowered to the bottom by cable on floats or cars, many of the business men preferring to pay the toll rather than work their horses excessively on the hills, for the greater part of the loads are carried from the lower to the upper sections of the city.

City Officials Investigate Haulage.

The city in its departmental work must meet with the same problems and the same conditions that the

Street Construction with a Tractor and Semi-Trailer at Springfield, Mass.: At Left, Taking a Steep Grade with a Load of 13 Tons; at Right, Spreading Asphalt from a Bottom Dumping Body.

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business men must meet and transportation is more expensive because of the topography of the city than it would be where the grades are more level. With a view of economizing, the city officials having in charge the general transportation of the municipality investigated the practical uses with tractors and determined a test which would include the haulage capacity of the machines, whether trailers could be practically hauled and controlled, whether a tractor could haul heavy tonnage up an eight per cent. grade, and whether there was such control with the tractor brakes that several loaded trailers could be stopped either ascending or descending the grade stated. These details were regarded as being essential and there was accord in the belief that a machine that would afford acceptable service to the city must be equal to the requirements stated.

Trial Made on 7000-Foot Grade.

The test was made on Gilbert hill, a street paved with granite blocks 7000 feet long, having a maximum grade of 8.3, a minimum grade of 1.8 and a mean grade of 6.2 per cent. In the trial six ordinary municipal type bottom dumping wagons were coupled together by the poles, as is shown in the illustrations. These wagons were used as trailers and were loaded with mud. One of the requirements was that there should be no load carried on the tractor, so that its traction should be obtained from its weight, and all the load carried by the trailers on the steel tires of their wheels. The total weight of the load in the trailers, and of the wagons was 38,550 pounds, or 19¼ tons, and without a load the tractor did not have the pulling power it would have had had it carried from 3000 to 4000 pounds. In fact, such a freight would have greatly increased its efficiency.

Starting at the bottom of the ascent the tractor hauled the train to the top and without stopping turned in a wide circle with the trailers tracking perfectly behind it and descended to the bottom. Descending, the tractor was driven in its low speed and this held the train without the brakes, which were set only to demonstrate their efficiency. Twice the train was stopped and the brake set where the hill is steepest, this being regarded as being a very satisfactory trial. A second trial was made with a sixth wagon loaded, this increasing the weight of the train to 45,670 pounds, as certified to at the city scale. The weights hauled in the trials were stated to be as follows:

Train of Five Wagons, Loaded.	
First two wagons	11,600 lbs.
Second two wagons	18,000 lbs.
Fifth wagon	8,950 lbs.
Total	38,550 lbs.
Train of Six Wagons, Loaded.	
First two wagons	11,600 lbs.
Second two wagons	18,000 lbs.
Third two wagons	16,070 lbs.
Total	45,670 lbs.

The result of these demonstrations was the purchase of the Knox tractor, and emphasis may be made that the weights hauled were approximately 25 per cent. in excess of what will be drawn with the tractor in normal operating conditions. The probabilities are that with differing weights carried on it the machine would have shown much more power, for there is no reason to believe that its haulage limitations were reached.

Tractor in Highway Construction Work.

Relative to tractor service, that obtained by a machine owned by Springfield, Mass., is worthy of attention, for this covers a period of time. The tractor is used with semi-trailer and trailers, according to the work, and during the season of the year when highway construction was in progress it was utilized a part of the time for the haulage of heated bituminous mixtures used to surface streets. The accompanying illustrations were made while street surfacing was under way at Indian Orchard, a suburb about seven miles distant.

The tractor was coupled to a bottom-dumping wagon of the type usually used for municipal construction haulage, this having capacity of eight tons. To this were attached two other wagons, each loaded with 2½ tons, making a total of 13 tons of asphalt mixture. The load was placed in the semi-trailer and trailers at the municipal mixing plant and was then hauled to Indian Orchard. The asphalt was heated to a degree that insured it being so plastic it could be worked at the end of the trip, and when it was deposited on the roadway from the wagon it was merely spread by raking and then rolled to level and consolidate it. This was a material saving and a great deal of work was done with a comparative small number of men.

One of the advantages of the tractor and trailer equipment was the minimized work of handling, both with the machine and on the road, for the spreading was in part done in dumping. The operating cost was found to be low because the load was carried on steel tires, and by changing the trailers a great diversity of haulage is practical. The tractor has never been worked to anything like its capacity. Working at Indian Orchard a trip of seven miles was made, either loaded or light, in an hour, and the machine climbed the Armory street hill in Springfield, which has a six per cent. grade, with ease.

With the tractor and trailer the possibilities for hauling heavy and bulky loads, including timber, stone, steel girders and similar material are evident, and the tonnage that can be drawn is very large—probably considerable in excess of 50 tons if the trailers can carry such load and the streets are reasonably level.

B. W. Burtsell, who has been assistant factory manager of the Packard Motor Car Company, Detroit, Mich., has been appointed sales manager of the Whitney Manufacturing Company of Hartford, Conn.

The Michigan Central railroad is said to have ordered more than 2500 automobile cars to handle the output of the Michigan motor car factories. These are being delivered at the rate of 25 a day.

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S. A. E. ANNUAL MEETING.

Three Sessions to Be Held in New York City Jan. 5 and 6.

Three sessions of the annual meeting of the Society of Automobile Engineers will be held at the Engineering Societies building, 29 West 39th street, New York City, during the New York automobile show. The first will be held Wednesday morning and the others Thursday morning and afternoon.

These meetings will be preceded by a meeting of the standards committee held the morning of Tuesday, Jan. 4, to which all members of the society are invited. Among the subjects which this meeting will consider are speedometer drive connections, narrower limits for sulphur, phosphor and manganese in steel; metal test specimens and tests, commercial metric equivalents for solid tire inch dimensions, standardization of motor truck wheel diameters less than 36 inches and electric wiring specifications.

The electrical equipment division of the committee has studied during the past two years adequate limitation of so-called headlight glare. The division has reached an agreement on the subject and a report will be made.

The first meeting of the whole society will be devoted to hearing reports and electing officers. Among the recommendations of the standards committee which will be considered are the standard location of identification numbers on cars, base dimensions of mechanically driven air pumps, inspection and physical test methods to be employed in the purchase of leaf springs, dimensions of lock washers for small machine screws and cone clutch flywheel housings.

The morning session on Thursday will be devoted to the addresses of President William H. Van Dervoort and of the president-elect. Dr. J. S. Unger will deliver a paper on the effect of sulphur content on steel, and "Electric Bulbs for Automobiles" will be discussed by Henry Schroeder. The discussion of electrical subjects in automobile engine design will be by Alexander Churchward, with Dr. R. H. Cunningham, Frank Conrad and Francis R. Hoyt taking part in the debate on battery versus magneto ignition, and Joseph Bijur giving a discussion of "Electric Lighting and Starting." The annual dinner will take place Thursday evening at the Hotel Plaza. Major-General Leonard H. Wood will be the guest of honor and will make an address.

Arrangements have been made so that the members of the society may visit a larger number of plants of various sorts in and about New York in which they may be interested.

The investigation of headlight glare is said to have led to the conclusion that the chief cause of glare is waste light thrown into the air about the light instead of being thrown on the road as is intended. The remedy is to be found, the investigators believe, not in a radical change in headlight construction, but in improved adjustment of the lights as they exist. Adjustments for the bulb are provided in present lights and it is possible also to adjust the reflector so that a desired result may be secured. That danger results from the lights at present in use is admitted by the engineers and some improvement must be made.

PRIVATE TRUCKS TO HAUL SNOW.

Street Commissioner Fetherston of New York has made elaborate arrangements for clearing the streets of snow after storms. The snow fighting force working under the direction of the department will remove snow during the storms, putting it in sewers or piling it up where no sewers are available. There will be a second section, known as the snow removal division, which will work with contractors' trucks to haul snow to the river front dumps or to sewers when storms are over. A first reserve will also be organized for day and night work after storms. This will consist of the city's refuse removal department and private trucks whose owners have permits to dispose of refuse at the city's dumps. A second reserve is being organized that will work with private trucks. Many merchants who find themselves unable on account of the snow to use their trucks in their own business are willing to use them in removing snow immediately about their own premises, but they have been handicapped in the past because they had not the right to use the city dumps. They are now to have that privilege.

MAY MARK NEW ENGLAND TRUNK ROADS.

Highway commissioners of the New England states have agreed that if a simple system can be devised the main trunk roads through out these states will be marked with distinctive colors on telephone or telegraph poles so that when a tourist is once started on the route he needs no guide book but the marks on the poles to keep him on the right road. To encourage tourist traffic in Massachusetts the highway officials of that state are building largely trunk lines. They are widening the surface on the roads to 18 feet and making the turns 21 feet wide. Last year they built 61 miles of new roads, of which 44½ were bituminous macadam and 2¼ miles were concrete.

The Myers Machine Company of Sheboygan, Wis., capitalized at $50,000, has been formed to take over the Wisconsin Motor Truck Company of Baraboo, Wis. Louis P. Helm, who has been making the Wisconsin truck for three years, will have charge of that department, while Myers will continue to manage his former business.

C. H. Brennan has been appointed manager of the Detroit branch of Hale & Kilburn of Philadelphia.

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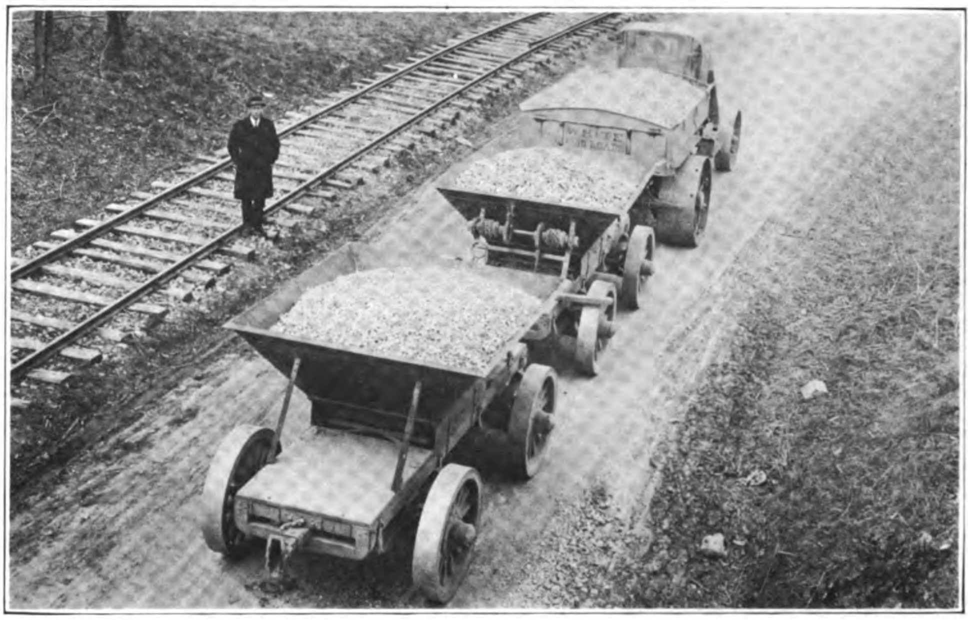
ROAD BUILDING ECONOMY WITH MOTOR TRUCKS.

Labor-Saving Equipment and Careful Supervision Obtains Marked Reduction of Construction Cost Both in Municipal and Contract Work on Highways.

PUBLIC highway building, a work in which every community is more and more vitally interested, is now so universally demanded by the people that the aggregate expenditure is a considerable part of the total amount of money raised annually by taxation. This statement can be applied to the states and to every form of municipal government. Not only is greater mileage necessary, but surfacing must be of a character that will lessen the cost of vehicular transportation.

Highways that were formerly believed sufficient, or were tolerated because of the belief that such improvement was not a public benefit, or were too costly, are now regarded as insufficient or intolerable, and there is no disposition to oppose taxation that will be devoted to the building of the best and most enduring forms of roads. America has approximately 2,500,000 miles of what is known as public road. Of this mileage approximately 10 per cent. is improved—that is, on which the surface has been worked to grade and has been surfaced, and is maintained more or less systematically. This doesn't include streets of towns and cities.

While the first demand for road improvement was for pleasure or driving purposes, the requirement of today is purely from economic reasons, so that there can be transportation between cities and towns at lessened cost. While there is no agreement among municipal engineers as to what form or width of road shall be best, because construction depends upon the money available and material that is locally obtainable, and different policies obtain with reference to development and maintenance, there are active influences that are gradually shaping public sentiment and promoting and encouraging legitimate expenditure for highway improvement.



White "Good Roads" Truck and Troy Trailers Which Hauled Road Material for .6 Cents a Ton Mile in Fayette County, Kentucky.

In some of the states there is systematic co-operation between the state and the municipal officials with regard to road building. There is a gradually increasing movement to employ convict labor for this work from the desire to employ the prisoner with what will be beneficial to the state and to decrease so far as possible the expense that penal institutions must incur and which must be paid by the people.

The magnitude of the work of road building, for which the United States is each year spending more than $250,000,000, and the requirements of funds for other public purposes, as well as the almost universal demand for highway improvement in every community, impels economies. There is no desire to build a cheaper or a less satisfactory form of highway. There is general recognition of the fact that the better the construction the longer will the roadway endure, and increased first cost is an insurance of decreased maintenance expense, provided that there is reasonably efficient care and upkeep. The best authorities on highway engineering are agreed that the real saving can be made by the use of specially adapted tools and machinery that will economize time and lessen the labor for a given work.

There are certain factors that must be considered. Labor is generally increasing in price. The proportion of convict work is so small as to be almost a negligible factor in American road making. The cost of material depends upon the quality that can be obtained locally, the width and depth of surfacing, the topography of the country and the need of bridges, culverts and other incidental construction. The real saving of labor and the preparation of and the handling of materials can be obtained by the use of machinery and facilities, and systematic organization and supervision.

This practical economy is being demonstrated in a

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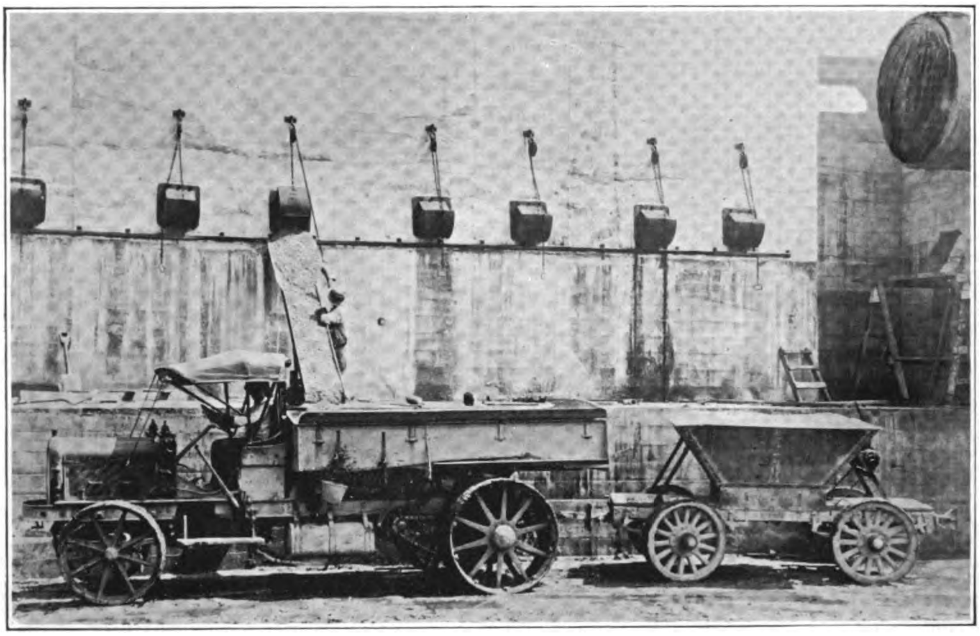
very certain manner in Fayette county, Kentucky, in which is located Lexington, the third city of the state in point of population. The total number of inhabitants of the county is about 48,000, of which about 9000 live outside of the city. The highways are maintained by the county, a board having jurisdiction over them, save in Lexington. The county has an area of about 370 square miles and about 385 miles of improved highways, of which 380 are water bound macadam, some of which is surface treated with asphalt.

Lexington is an important commercial centre and is the location of several colleges. It is widely known as a market for loose leaf tobacco. From it highways diverge to the county seats of the adjoining counties of Winchester, Nicholasville, Versailles, Georgetown, Richmond and Paris, and there are main or trunk roads to the larger and distant cities. Kentucky is rough in topography and as a state its proportion of improved roads is comparatively small, but Fayette county leads the commonwealth in highway development work, largely through the endeavors of its progressive people.



Loading the White "Good Roads" Truck and Trailers by Gravity at the Central Supply Plant in Fayette County, Kentucky.

Until 1906 toll was exacted for travel on most of the main highways, but in that year Frank A. Bullock, who was a county judge, purchased the private rights in the roads for $352,000, and today as judge of the fiscal court he has paid this sum and the county is practically out of debt. Having acquired the roads the next problem was to develop and maintain them, and differing plans were tried until 1913, when County Engineer Robert W. Davis was appointed. Up to that time the work on the roads was done by contract and the county did not own machinery or tools of any kind adapted for maintenance.

Work Started with New Equipment.

The system then the vogue had continued for a half century and it did not appeal to Mr. Davis as being productive of anything like the results and economies that the people demanded. He presented his plan and it was so logical that he was authorized to adopt it. This comprehended the abolition of contracts, the establishment of a central supply station and facilities for doing all the work that was practical to do, the purchase ot equipment specially designed for road building and maintenance and the development of an organization for carrying on the work.

The station is located on a railroad and it has storage space for 400 tons of road surfacing material, which is handled largely by gravity. The tanks for liquid asphalt will hold 24,000 gallons, there is a store house for cement and other materials that must be protected from the elements, and the steam heating and power plant is adequate for all requirements. For work on the highways the county bought a White "good roads" six-cylinder truck for hauling road building machinery and carrying material, a White liquid asphalt tank wagon or distributor for applying asphalt to the road surfaces, two four-yard capacity Troy trailers, one elevating grader, one scarifier, one rotary road broom, two road rollers and two mixers for treating broken stone with asphalt and making concrete.

In the plan for supplying material the stone is obtained from 13 quarries owned by the county and operated by contractors, and the stone as quarried is shipped by railroad to a central crusher that is worked by inmates of the county work house. This greatly reduces the cost for labor and more than offsets the expense of transporting the stone from the quarries to the crusher. The crushed stone of desired size is shipped from the crusher to the supply station and the cars are hauled on to a track elevated above the storage bins, so that the stone may be unloaded by gravity from the cars. There are eight bins, each having 50 tons capacity. On the side of the bins opposite the track are 16 outlets, two for each bin.

That the loading from the bins to truck may be done by gravity there is a steel chute mounted on a truck so that it may be moved to any desired outlet. When the chute has been placed in position the gate of the outlet is raised by a chain pull and any volume of stone will fall into the truck. This is as practical a method of handling the stone as could be devised at a permanent station, and because of the desire to utilize the work house labor the plan works out economically, although in other conditions this result might not

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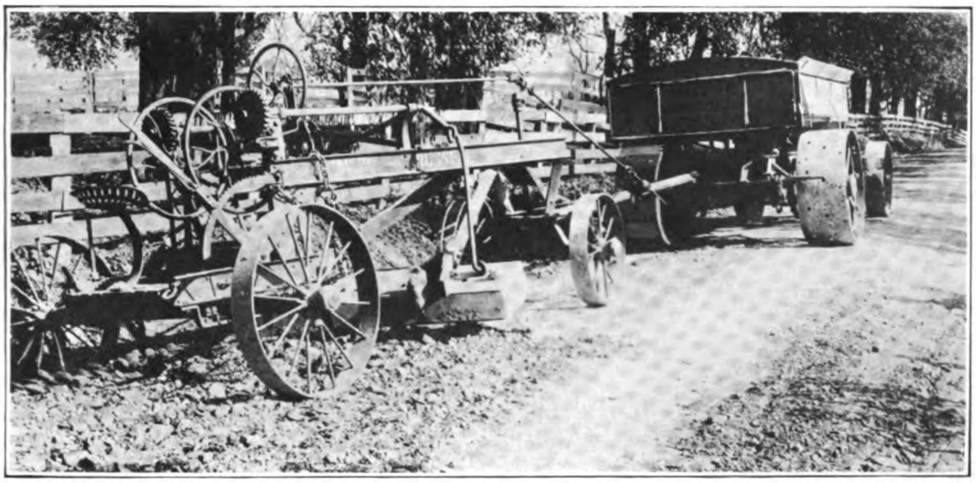


White "Good Roads" Truck Drawing a Road Scarifier—One of the Many Works for Which the Machine Is Serviceable.

be dumped in any one place. When feasible the stone is spread, as this minimizes the hand labor of levelling and evening before consolidation by rolling. The mixers are largely used for making concrete, which is made into blocks or is carried to a work and poured into forms, according to the requirements. Concrete is used mainly for bridges, culverts and abutments. The mixing can be done economically at the station, where the mixers are located and the stone can be obtained in any size that will best serve.

be obtained to the same degree.

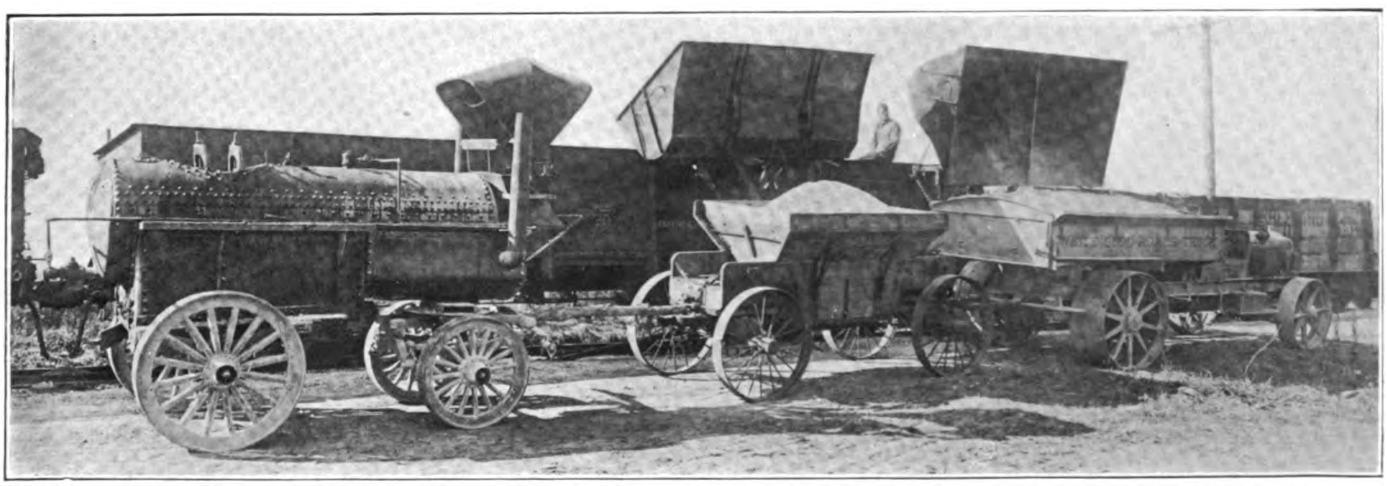
The asphalt is handled quite as cheaply by gravity methods. It is received at the supply station in tank cars that are carried in on the spur track of the supply station. The storage tanks are located lower than the track and by connecting the tank cars with the steam systems the material is liquified and flows into the tanks, each of which will hold 12,000 gallons. In the tanks are steam coils, and these are heated to liquify the asphalt so that it will flow into the tank of the distributor. There is no need of handling either of these materials from the cars to the roads. The asphalt distributing tank is mounted on a truck equipped with a steam heating plant in the form of a White steam generator, in which the heat may be maintained to 260 degrees or higher, as necessary. There is a pump driven from the transmission gearset of the truck chassis which forces the asphalt through the distributor under pressure to obtain any desired degree of penetration. Of course the asphalt can be applied uniformly and in any volume to the square yard needed for the work.

The White "good roads" truck is fitted with a power hoist that will elevate the body so that any load may be discharged, and the stone may be gradually spread on a surface the width of the body, or it may

The road building equipment of the county is worked by an organization of 20 men, which is but a small part of the number that would be necessary with other methods. The cost of hauling has been reduced to $.044 a ton mile. During the past year 22½ miles of macadam surfacing was rebuilt on seven different roads, this requiring about 1200 tons of stone a mile, and in addition to this 80,000 gallons of asphalt were applied to about 25 miles of road, 30 concrete bridges were built and about 8000 feet of culvert were laid. An illustration of the efficiency of the organization and practical economy obtained is the building of a concrete bridge for about $400, for which the contractors' bid from $750 to $1100.

The Economies of One Season.

The use of the trailers with the truck for hauling road material affords a marked saving, because of the practical elimination of labor in handling. In 120 working days from May 1 to Oct. 31 of this year, the truck and the two trailers hauled 5882 tons of stone, this being the tonnage placed in the bins as shown by the railroad weights. The smallest tonnage was in May, when the weight was 1,748,300 pounds, and the largest was in September, when it reached 2,690,440 pounds. The average tonnage for each working day



White "Good Roads" Truck, Trailer and Asphalt Tank Used in Road Construction at Griffith, Ill., by a Highway Contractor.

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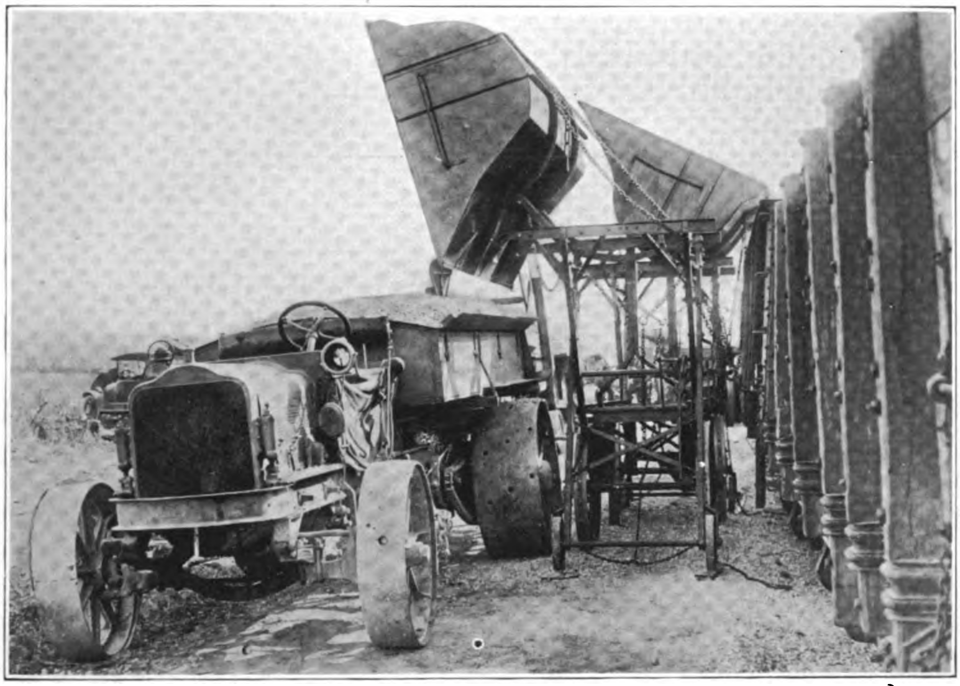
was 49, and the average distance was four miles, or eight miles for the round trip of the truck and its train. The cost for operating was $9 a working day, or $1.184 a ton and $.046 a ton mile. Taking a typical day's work in hauling stone for the construction of water bound macadam the saving was $43.77.

Truck Production for Other Work.

But in addition to the haulage the truck was used for other work. It was worked with the scarifier when necessary, and was quite as useful for work with an elevating grader. Besides this, 300 tons of coal was also hauled to the county infirmary, this saving the cost that would have been charged with delivery. The truck and the trailers have been found to be a remarkable economy in the road building, but they can also be used to advantage in other necessary county work, so that with reasonable charges for these services the operating and maintenance cost can be kept down.



The White Truck and Trailer Being Loaded with a Lee Portable Unloader That Was Placed at the Cars at the Railroad Siding.

While it can be used but a part of the year on the road, the truck may be utilized for many purposes and be reasonably productive when it is not worked on the highways.

The success with the plant and equipment has resulted in plans for greater work the coming year, and the intention of the county officials is to spend about $400,000 for highway construction, which will include the building of 23 miles of the Dixie highway, and the main roads from Lexington to the adjacent county seats will be improved with bituminous concrete built on old macadam foundations. Besides this, other roads from Lexington will be rebuilt. Much of the work will be done with state aid, but the county will reserve the right to do this work as a contractor, and in this will protect itself and obtain the economy that its facilities and equipment will obtain.

While the work in Fayette county has been with permanent equipment and a well trained organization, there was no standard for economy or efficiency, the methods being developed as most appealed to an engineer who was seeking to obtain rational results with well chosen facilities. There is, of course, greater incentive for the contractor, because he is undertaking a work for a specific price, to insist upon the greatest economy of time and labor, and there is abundant reason to believe that equipment that is efficient and economical in similar work can be used to equal advantage in road contracting.

This statement is borne out by the experience of Thomas Levene in building a road at Griffith, Ill., who used machinery and tools that could be adapted to the work and materially lessen the number of men and vehicles that would be required with the usual hand and horse equipment utilized in such construction. This work was not an experiment in the sense of a trial of unknown machines, but it was a demonstration of a well developed plan and practical methods that has been carefully studied to meet the conditions.

Well Built Asphalt Macadam.

The road was asphalt macadam that was built 2½ miles from a railroad siding, so that all of the materials were hauled from the cars that were placed on the track for unloading. The road was 30 feet width, excavated six inches to a sub-grade, and on this was placed six inches of slag for a foundation and with a slag shoulder. On this slag was placed the surface course of two-inch stone rolled and consolidated to three inches, which was bound with asphalt applied at a pressure of 25 pounds at a temperature ranging from 320 to 340 degrees.

In this construction, after the sub-grade has been established, the slag was laid and rolled and the course of stone consolidated. The hot asphalt was spread, and as this was distributed chip stone was scattered by shovellers from wheelbarrows to a depth that fully covered the bitumen. Before the asphalt had cooled the chip stone was rolled with a steam roller, this consolidating the chip stone and the surface course. The chip stone was next treated with an application of hot asphalt, and this was covered with shovel-spread stone screenings, which was also rolled. This made the surface of three layers or coats of different sized stone, all bound with asphalt, on a base course of slag.

Labor Saving Equipment.

With horse carts for hauling the stone from the cars, in addition to the time required for actual haul-

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The Train of Truck, Trailer and Asphalt Tank on the Road Between the Railroad Siding and the Work Progressing on the Highway.

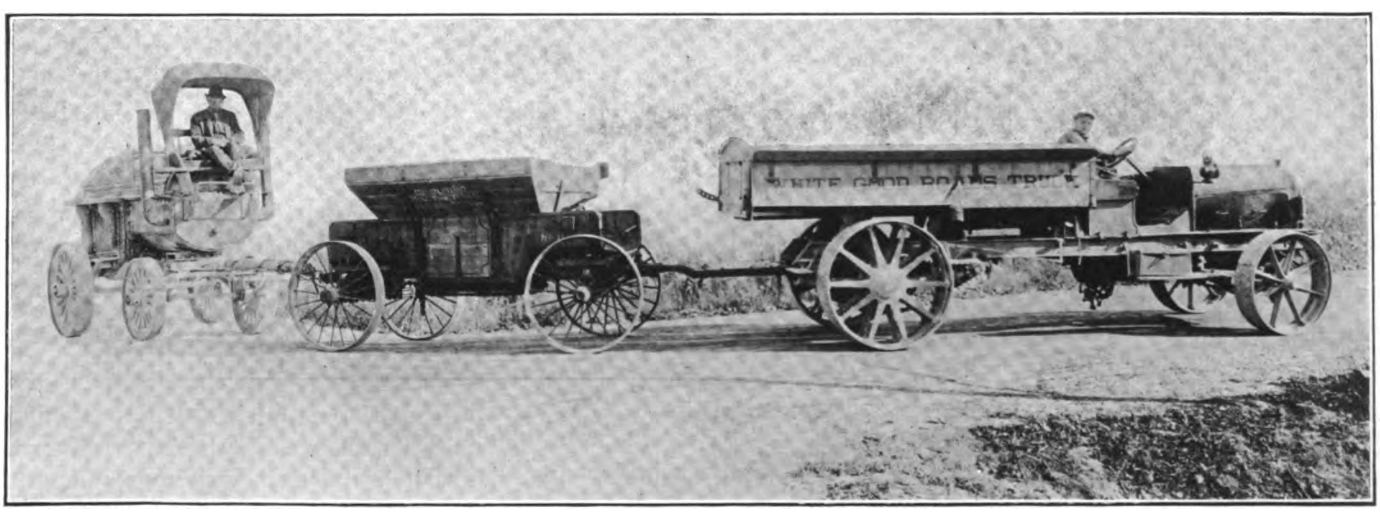
age, the drivers would have to hand shovel the loads from the cars to the carts while their teams waited, or the waiting period might be reduced by having additional men at the cars. There would be the expense for the labor or for the animals, carts and drivers, and during the time the teams were on the road the shovellers at the cars would be idle. To meet this condition a pair of Lee portable unloaders were obtained. These are steel bins, arranged to dump at one side, mounted on steel frames that are carried by four steel wheels on which they may be moved.

These unloaders may be drawn to any place and located beside a car. The contents of the cars are shovelled into the unloaders until they are filled. The carts or trucks may be driven beside the unloaders and the bins dumped instantly, so that practically no time is required for loading, and by timing the work of the shovellers the number of men necessary to fill the unloader bins between loadings can be learned. The number of unloaders depends entirely upon the tonnage to be handled and the distance the loads are hauled.

Real Saving on One Part of Work.

In the construction of this road the excavating and laying of the course of slag and the second course of stone was worked economically, but the real saving was made in the laying of the chip stone and screenings and the application of the asphalt. Two Lee unloaders were located at the railroad siding at the cars, and a gang of four men manned them. The haulage was done with a White "good roads" truck and a trailer from the cars to the job. The asphalt was received by cars and was heated by steam from a portable boiler and liquified so that it could be forced from the tank cars under pressure to wagons fitted with 600 gallon tanks and furnaces in which the heat of the asphalt could be maintained by wood fires during the time it was being hauled to the work and while it was being distributed on the road surface. The pressure for distribution was obtained from hose connected with the steam roller that hauled the tank wagon behind it during the time the asphalt was being applied.

The truck, beside hauling the three-yard trailer, hauled a tank wagon each trip, taking 600 gallons of asphalt and sufficient chip stone or screenings. The truck and trailer loads were dumped for convenience of the gang on the road work and leaving the tank wagon to be coupled to the road roller and the asphalt spread as wanted, the truck hauled the empty trailer and an empty tank wagon back to the siding. Here the truck and trailer were loaded without delay at the unloader, and then the third tank wagon, which has been filled during the absence of the truck, was coupled on and hauled to the work. This necessitated the use of three asphalt tanks. The round trips of the trains of truck, trailer and tank were made in less than an hour, and as the truck and the three-yard trailer carried sufficient stone for use with each tank of asphalt, the work at the roadway was so timed that the men were kept busy. The trips were made so quickly that fires were not necessary in the tank furnaces to keep



The Truck and Its Train Were Driven a Round Trip of Five Miles in Less Than an Hour, Including the Time of Coupling and Uncoupling and Loading and Discharging.

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the asphalt at a temperature at which it could be advantageously worked.

Saved Time of Men and Teams.

To have done the haulage with horses would have required three firemen and three drivers and three teams of four horses each for the tank wagons, and to have hauled the stone that was drawn by the truck and the trailer would have taken nine two-horse carts and nine drivers. This is a total of 30 horses and 15 men, and the men would have had to handle the stone at the cars. With only a driver and the crew of four at the unloader the work was done more rapidly and uniformly and there was no loss of time at the road through delays between the work and the railroad siding.

With the equipment 6000 gallons of asphalt or more could be applied in a single day, and about 80 yards of stone hauled. The progress made would depend largely upon two factors—the width of the road surface and the volume of asphalt applied to the square yard of surface. The distribution of the asphalt is uniform and more economical than when hand poured, for with hose and nozzle it may be applied wherever desired and in exact volume. The entire width of the road may be treated in a single operation if desired. By using three tanks the work on the road was carried on without cessation.

An Economy of $65 a Day.

With the price for labor at $2 a day and horse teams at $3 each, the saving of the work of 10 men and 15 teams was estimated at $65 a day by Mr. Levene. This was possible through the investment of $5700 for a White "good roads" truck and trailer and $800 for a Lee unloader, a total of $6500. In addition to this the tank wagons were purchased. In the construction of an asphalt storage plant Mr. Levene was joined by A. L. Courtright and Downey & Portz, two contractors. The method of road building created much attention in the section of Illinois in which the work was done, and the highway officials of 25 counties met at the job and observed with much interest the results obtained with the equipment.

The saving practically depends entirely upon the work that a contractor can do, and assuming that there is a full season's work the saving by the use of the equipment on jobs of the same proportions would pay for it in a year in which there were 100 working days. But in addition to haulage of stone the truck and the trailer can be used for excavating and similar work, and during the time when road building cannot be carried on they are equally serviceable for other forms of haulage.

The Lenox Motor Car Company, Boston, has closed negotiations with a contractor who has a very large order for trucks from the Allies to build from 500 to 1000 three-ton trucks. The machines will be built at Hyde Park, Lawrence and Fall River, the company having acquired factories in those cities following its reorganization with a capital of $1,000,000.

BAKER-R & L-OWEN MERGER.

General Electric Company Interests Acquire Control of the Two Companies.

The Owen Magnetic Company of New York has been combined with the Baker-R & L Company in Cleveland, O., and the General Electric Company, which recently acquired the Entz patents under which the Owen magnetic transmission is made, is a party to the deal and will have three directors on the new board.

The Baker factory in Cleveland will be used to manufacture two models of gas-electric passenger cars which will be known as Owen Magnetics. The R & L plant will continue the production of electric storage battery vehicles and will make bodies for the gas-electric cars. The Baker line of storage battery trucks will be continued. Nothing has been said as yet regarding gas-electric trucks, but this may be a later development.

The capital of the Baker-R & L merger is increased from $2,000,000 to $5,000,000. R. M. Owen, who has been president of the Owen Magnetic Company, is made vice president and sales manager of the new combination.

On the board of directors of the company will be Anson W. Burchard, vice president of the General Electric Company; D. C. Durland and Richard H. Swartout. The Owen factory in New York will be used for development purposes and as a service station.

The Fort Wayne factory of the General Electric Company is already equipped with tools in preparation for producing the Entz transmissions in quantity.

LEASE GAYULE RUBBER LAND.

Since the announcement that the United States had recognized the Carranza government in Mexico, American syndicates are said to have leased large areas of land on which the gayule shrub grows for rubber production. The development of this business has been at a standstill during five years of revolution and large amounts of gayule have grown up in that time, so that there is at present a large quantity of raw material available. Two rubber factories at Torreon are said to be projected.

PACKARD MANAGERS REPORT PROSPERITY.

Packard truck sales managers recently called to the factory at Detroit, Mich., to examine the new one and 1½-ton light trucks which are now being produced, reported that the branches were having unprecedented prosperity and express the belief that the greatest year in the history of the industry is in prospect.

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THE STEWART 1000-POUND DELIVERY WAGON.

BUILT to afford the service that is required of a vehicle used for delivery purposes, to design that was carefully studied and developed, the Stewart Motor Corporation, Buffalo, N. Y., is now producing a machine of 1000 pounds load capacity that is sold for $695 as a stripped chassis and for $750 when equipped with an express body. The vehicle in every respect conforms to approved truck design, being unusually simplified and extremely accessible, and it is constructed with very large factors of safety so that it ought to have great endurance and exceptional service life.

Considerable attention was directed toward obtaining loading space, so that the machine might be used for carrying bulky freights and yet have the load equalized. There is a space 72 inches long back of the driver's seat and all of this can be utilized without exceeding the limitations fixed for the design.

The type is intended for a very large class of business men who require light and fast equipment, that can be operated and maintained economically, and which will entail exactly the same character of attention of machines of much larger size and capacity. It is designed to meet the demand from truck dealers who wish to develop custom from the largest number of business men—a field that promises remarkable returns.

The motor is a four-cylinder, valve-in-the-head type, with cylinders having three-inch bore and 4¼-inch stroke, developing 25 horsepower. The S. A. E. rating is 14 2/5 horsepower. The carburetor is a vertical type with an adjustment on the dash. It is controlled by a foot accelerator. A Bosch high-tension magneto with a fixed spark supplies the ignition current. The honeycomb type radiator is of ample size and cooling water is circulated through the engine jackets by a thermo-syphon influence. A two-bladed fan mounted on ball bearings draws air through the radiator and promotes radiation.

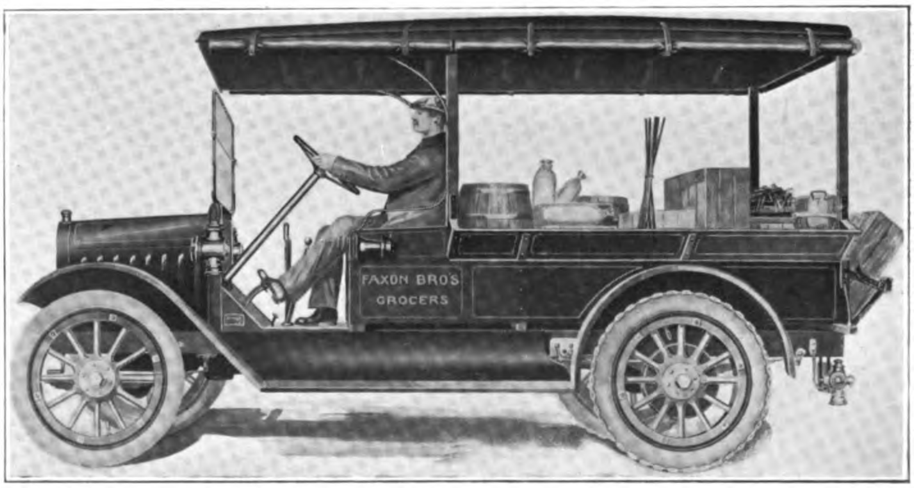
A multiple disc dry plate clutch with asbestos facings is fitted with automatic adjustments. The selective sliding gear transmission gearset has three forward speed ratios and reverse. The engine clutch and transmission are combined in a unit power plant.

The gear ratios of the transmission gearset are 1-1 in high, in intermediate 1.7-1, in low 3.2-1, and in reverse 3.9-1. The gear ratios from the engine to the rear wheels are: High, 6-1; intermediate, 10.2-1; low, 19.2-1; reverse, 23.4-1.

The drive is taken from the transmission gearset to the rear axle through a tubular propeller shaft with universal joints at either end.

The rear axle is a Celfor internal gear driven design, built especially for commercial work, and is very strong and reliable. The front axle is a drop forged I beam section with unusually large spindles. The frame is a pressed steel channel section made from stock 5/32-inch thickness. The side rails are four inches deep and there are three cross members. The springs are a semi-elliptic type, the front set being 34 inches long and two inches wide, while the rear springs are 46 inches long and two inches wide.

The artillery type front wheels have 12 1¼-inch square spokes and the rear wheels have 14 1½-inch square spokes. Pneumatic tires are used, 32 by four-inch front and rear, with non-skid casings on the rear. Firestone demountable steel rims, with one extra rim, are standard equipment.



Stewart 1000-Pound Load Capacity Internal Gear Driven Delivery Wagon, Equipped with a Standard Express Body.

The brakes operate on pressed steel rear wheel drums, 14 inches diameter. The service brakes are equipped with an equalizer. The steering gear is mounted at the left side. The wheel is 16 inches in diameter and is adjustable and irreversible. A spring drag link is used for absorbing shocks. The standard equipment includes a glass front, a mechanical horn, two oil side lamps and an oil tail lamp, tire irons, tool kit, jack and tire pump.

DINE NEW YORK'S SECRETARY OF STATE.

A dinner was given Dec. 15 at the Waldorf-Astoria, New York City, to Secretary of State Francis M. Hugo by the special inspectors of the state automobile department. He was presented a large chest of silver. The board of governors of the Automobile Club of America were present, the New York State Automobile Association was largely represented and many of the automobile companies had tables of their own. Several very prominent motorists made speeches.

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MOTOR TRUCK CLUB TO EXPAND.

Members Plan New Policies to Develop Greater Scope of Influence.

Plans to enlarge the scope, strengthen the financial position and adopt a more aggressive policy were made by the Motor Truck Club of America at its annual meeting, which was held Dec. 15 in New York City.

Efforts will be made to secure a direct and close relationship between all the members of the club; opportunity will be given all members for active service through appointment on various special committees; division of the club work into special departments with committees to carry out the club plans in various lines; opportunity for the members to express their opinion as to the direction in which club activities should be guided, are some of the activities and policies planned.

A members' council will be formed which will be representative of the various business interests of the members. The council will serve as a guide to the club executives and will initiate subjects for investigation and agitation. Action was taken at the meeting protesting on the proposed federal tax on gasoline.

Ellis L. Howland, who was formerly secretary of the club, was re-elected to the position after a year's absence from its roll of officers—as a testimonial to the effective work which he had done for it. Other officers elected were: President, T. D. Pratt; vice president, Roderick Stephens; second vice president, David C. Fenner; third vice president, Haywood P. Cavalry; treasurer, Nathaniel Mallouf; directors, George H. Pride, Joseph K. Orr, Emanuel Lascaris, Elmer B. Clark and A. J. Slade.

MOORE JOINS SERVICE COMPANY.

Paul Moore, formerly connected with the advertising department of the Weis Fiber Container Corporation of Monroe, Mich., has been appointed advertising manager of the Service Motor Truck Company, Wabash, Ind. Mr. Moore got his first advertising experience with the National Cash Register Company and was later connected with the sales and advertising department of the Shenango Pottery Company of Newcastle, Penn.

BURD RING COMPANY'S NEW BUILDING.

The Burd High Compression Ring Company has just completed a new building in which its product is manufactured. It is of the monitor type, with fire proof construction throughout, 190 feet long by 129 feet deep and one-story high. It has manufacturing space of 19,000 square feet. The production is about 25,000 rings daily and 250 men are employed. The company has seven factory branches and sales offices in 17 leading cities.

COMMERCIAL USES OF BALL BEARINGS.

"Ball Bearings in Commercial Applications" is the title of a handsomely printed book with many illustrations which has just been published by the New Departure Manufacturing Company of Bristol, Conn. It is distributed free to all who are interested.

The book, while it is devoted to the interests of the New Departure product, is an exposition of the uses of ball bearings in various types of machinery and is not confined to New Departure bearings. Many of the illustrations show machine and construction in which ball bearings of some other make are used. This gives the book a wide general interest for any one interested in bearings.

Perhaps the chief interest in the volume is in the number of uses for ball bearings that are illustrated and enumerated, showing that this type of bearing has been successfully applied for work in which plain bearings, roller or some other type of bearing has been used.

There is a chapter on the strength of ball bearings, showing that a weight of 75,000 pounds, nearly twice that of a loaded 10-ton truck, could be supported on a single steel ball. Diagrams and illustrations are given showing all the points in a motor truck where ball bearings can and have been used to advantage. The use of ball bearings on engine crankshafts is the subject of another chapter. Others are devoted to "Ball Bearings in Power Plant Auxiliaries," "How Ball Bearings Are Used in Motor Truck Clutches," "Ball Bearings in Change Speed Gearing," "Ball Bearings on Motor Truck Jack Shafts," "Ball Bearings in Double Reduction Internal Gear Drive Axles," "Ball Bearings in Worm Drive Axles," "Ball Bearings in Heavy Duty Motor Truck Wheels," "Ball Bearings Conserve Current in Electrically Propelled Trucks," "Ball Bearings Reduce Friction in Trolley Car Axle Journals," "Ball Bearings in Agricultural Tractors," "Ball Bearings in Industrial Tractors," "Ball Bearings and Modern Track Haulage with Gasoline and Electric Locomotives," "Ball Bearings in Heavy Service Road Tractors," "Ball Bearings in Motor Driven Fire Apparatus," "Ball Bearings in War Service," "Ball Bearings Save Power on Land and Sea" and "How Ball Bearings Are Tested to Determine Endurance."

From these it will be seen that the scope of the book is unusually broad.

AUTOCAR CAPITAL INCREASED.

The Autocar Company, Ardmore, Penn., has increased its authorized capital from $1,000,000 to $2,000,000, to take care of its increasing business, and at the same time enlarged its board of directors. The new members are James S. Austin, a resident of Ardmore, with large manufacturing interests throughout the country, and Frank C. Levin, who has been assistant secretary and treasurer of the company for some years.

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THE ACME TWO-TON WORM-DRIVEN TRUCK.

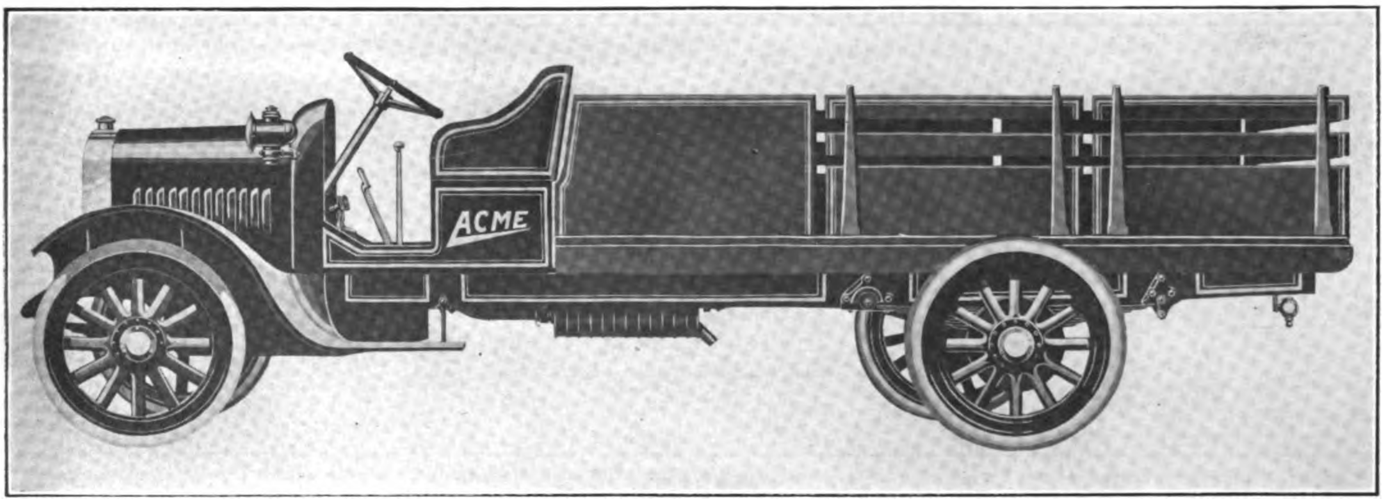
A TRUCK of proved units is the description made by the builder, the Cadillac Auto Truck Company, Cadillac, Mich., of the Acme truck, a machine of two tons capacity that it recently produced, and which is the first of a series of vehicles that the company will manufacture. This description, or statement, is based on the fact that it is constructed of parts or assemblies manufactured by 15 different companies that are known and recognized by the motor vehicle industry, all of which are representative products.

The company was recently organized with ample capital and facilities for manufacturing, and the executives determined that they would build machines that would be established so far as reputation is concerned by the quality and character of the materials of which they were constructed. To this end the engineer who designed the Acme truck carefully studied the requirements of the market as represented by progressive business men. His determination was that there was a demand for high-grade vehicles, and that for such machines the public is willing to pay a fair value.

To design and experiment with each principal unit to bring them to what would be regarded as a satisfactory standard of efficiency would require time, the investment of a large sum in initial development and later whatever capital would be justified by the results obtained, and the expenditure of a considerable amount for promoting the enterprise and establishing a legitimate reputation such as would impel public confidence and have a substantial value in the motor vehicle market. To have followed this course might have been good judgment were there a desire to establish the commercial value of a product that had exceptional and distinct qualities, which the company exclusively controlled, but to the contrary the purpose was to build what was undoubtedly demanded by the public, for which there was a market and which would be a type that was as thoroughly known as was practically possible through the reputation of the materials from which it was constructed.

Specialized Units Selected.

The engineer then determined to build the machine from components that were specialized—that had been developed by manufacturers who produce parts and materials that are the result of scientific engineering, the highest type facilities, skilled workmanship, and which could not be regarded in any way as experiments, and to use those sizes and types that would insure well balanced and substantial vehicles. The selection of these units—those which were adapted for use with each other and which would result in an equalized construction, with uniform factors of safety, with the desired economies of fuel and lubricant, with the fullest accessibility and simplicity, and which could be assembled by trained mechanics and by standard facilities, was the undertaking.



Side View of Acme Two-Ton Truck Chassis Equipped with a Platform Body with Sectional Side Panels for All-Purpose Work.

In the choice of components there was also a desire to insure the purchasers of the machines that they would have not only the guarantee of the company, but also the assurance of the makers of the units of whatever character of service that might consistently be expected. First of all a worm and worm wheel power transmission system was decided on as having the necessary efficiency and economy, as well as protection, and the units selected included Continental motors, Warner clutches and transmission gearsets, Timken axles, Detroit springs, Long radiators, Gemmer steering gears, Eisemann magnetos, Smith frames, Rayfield carburetors and Pierce governors.

A Truck Built to Fit the Traffic.

The company maintains that the only question with the business man of today who is purchasing a motor truck is one of comparison, and that these comparisons have well established the value of design. That innovations are not looked for or regarded favorably, and that there is undoubted confidence in what is proven

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to be dependable and reliable in average service and with reasonable care and attention. The purpose of the company has been to fit the truck to the character of traffic that is found in ordinary business, to do any work for which it is practical economically and well, and to have long life and endurance because of stable construction.

Claim is made that in comparisons with existing types of two-ton trucks the Acme truck has longer wheelbase, the motor is larger, the transmission gearset is heavier and the construction throughout is of greater size to obtain the strength that is so essential to operating economy.

Continental Motor a Standard Type.

The Continental motor is a standard type, a four-cylinder, four-cycle, water cooled, L head, vertical construction, with cylinder bore of 4⅛ inches and stroke of 5¼ inches, rated by the S. A. E. formula at 27.2 horsepower, but claimed by the builder to develop approximately 40 horsepower at 1500 revolutions a minute. The cylinders are cast en bloc from a special grade of gray iron with the water jackets integral, there being a separate water jacket head of large size that is retained by cap screws. This construction insures uniformity of the water jackets and more efficient cooling by thorough clearance of the water passages and obtaining free circulation.

After casting the blocks are tested by water pressure and are rough bored. They are then aged to insure against distortion from machining strains, and next follows a second water test, after which they are finish bored and ground to exact dimensions. The pistons are cast from the same material as the cylinder block. These are turned and when finished by grinding are five inches length. Each piston is channelled for three 3/16-inch diagonally split concentric expansion rings, and a series of oil grooves are turned to insure distribution of the lubricant on the piston and cylinder walls. The rings are specially machined to relieve expansion strains and are ground on the faces and sides. Much care is taken in fitting the rings to obtain a standard of compression. The holes for the wristpins are bored on special machines to secure accurate diameters and perfect alignment. All pistons are carefully weighed and carefully balanced by tests.

Crank Case in Two Sections.

The crank case is an aluminum alloy and is cast in two parts, there being an upper section that carries the main bearings, and this is divided by a transverse vertical web in which is mounted the centre main bearing. The lower section is the oil pan, below which is the oil reservoir. The construction is such that the main and connecting rod bearings are accessible by removing the lower section without dismantling the engine.

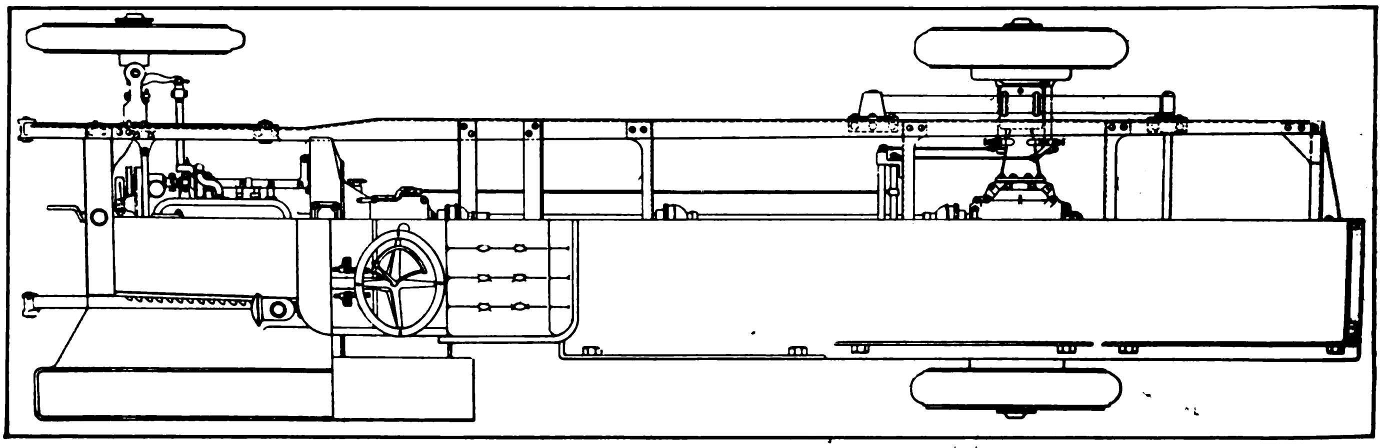
The crankshaft is a special steel drop forging that is made with the flywheel flange integral, and there are flanges formed at either side of the centre bearing to take end thrust from the clutch or any other influence. The main bearings are 1¾ inches diameter and from front to rear are respectively 2 9/16, three and 3 13/16 inches length, this giving a total of 9⅜ inches bearing length. The shaft is carefully ground and heat treated to have a tensile strength of 90,000 pounds to the square inch.

The connecting rods are .35 carbon steel I section drop forgings that are bored and reamed on special tools to obtain correct centres and alignment and are heat treated. These are fitted with caps at the big ends that are retained by four nickel steel bolts. The wristpins are special steel tube that are hardened and ground to size. These pins are retained in the bosses of the pistons by locking. The small ends of the connecting rods are fitted with bronze bushings that oscillate on the wristpins.

The camshaft is a single-piece low carbon steel drop forging with the cams integral with the shaft. The shaft is 1 1/16 inches diameter and it is mounted on three bearings that are respectively from front to rear 2¼, 1⅞ and 1⅞ inches diameter and 2 5/16, 1½ and 1¼ inches length. After it is turned and the cams have been rough machined and annealed the shaft is heat treated. It is then finish ground on a special grinding machine.

Bearings, Timing Gears and Valves.

The crankshaft, camshaft and connecting rod bearings are a high grade of nickel babbitt metal, the crankshaft and connecting rod bearings being fitted in



Sectional Plan View of the Acme Two-Ton Truck, Showing the Details of Chassis and Body Equipment Previously Illustrated.

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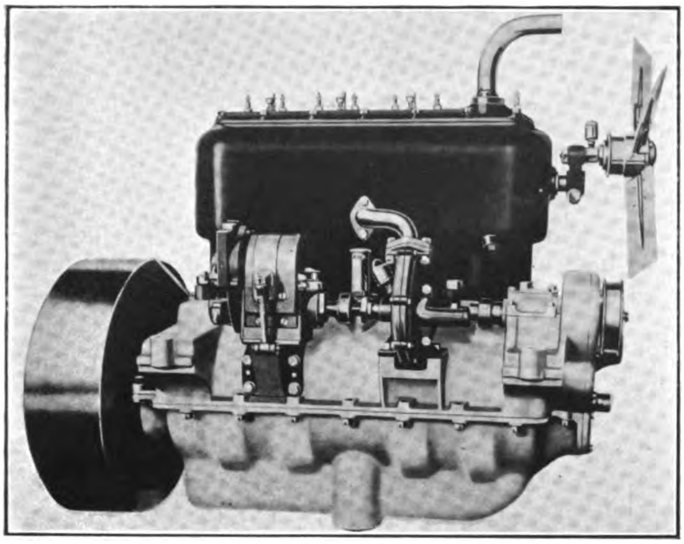


Right Side of the Continental Model C Motor Used in the Acme Two-Ton Truck.

bronze cages or shells in which they are held by brass retaining screws. The bearings are carefully fitted, expanded, reamed and finished by burnishing. The connecting rod bearings are adjustable by the removal of steel shims.

The timing gears are four in number, there being a crankshaft, camshaft, pump shaft and idler gear in each set. These gears are helically cut to obtain noiseless operation and much care is taken to obtain accurate gear centres. The set is enclosed in a housing formed by an extension of the forward end of the crank case.

The valves are made with nickel steel heads electrically welded to carbon steel stems that are seated in ports two inches diameter and are mounted in long guides that may be renewed when worn. The ends of the valve stems are hardened. The valve size and large clearance insure efficient scavenging and inhausting of adequate charges of fuel. The valves are actuated by tappets of mushroom type that are mounted in removable guides fitted in the base flange of the cylinder block, and which are adjustable with screws and lock nuts. The valves are actuated by oil tempered springs retained by a special locking device. The valve mechanism is enclosed by two cover plates that are quickly removable.

Cooling and Lubricating Systems.

The engine is cooled by a circulation of water forced through the jackets and the Long truck type radiator by a centrifugal pump that has two extra large bearings and stuffing boxes. Radiation is insured by a large fan mounted on a ball bearing in an adjustable bracket on the forward end of the cylinder block, that is driven by a flat belt from a pulley on an extension of the water pump shaft.

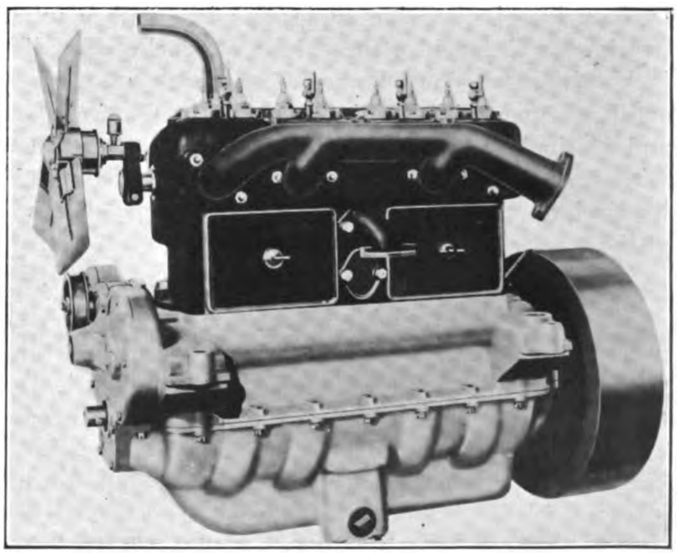
The engine is lubricated by a combination force feed and splash system. The oil is carried in the reservoir and is drawn through a filtration screen by a double vertical plunger pump driven by eccentrics from the camshaft and forced through copper tube to the timing gears and the rear main bearings. The oil drains to the pockets in the pan beneath the crankshaft and is distributed by splash for the lubrication of the cylinders, pistons, connecting rods, camshafts, centre main bearing and valve tappets. The camshaft is lubricated by oil from pockets cast in the crank case, and the wristpins by oil that is trapped in openings in the upper ends of the connecting rods.

The intake and exhaust manifolds are cast separately and are clamped to the valve side of the engine block. The fuel is supplied through a Rayfield automatic float feed type carburetor, with a Pierce governor fitted between the carburetor and the intake manifold that limits the speed of the vehicle to 17 miles an hour. This governor is automatic and is sealed when fitted and adjusted. The current for the ignition system is supplied by an Eisemann magneto of water proof construction that is operated with a fixed spark. The fuel is controlled by a hand throttle and a foot accelerator.

The Power Transmission System.

The engine is combined as a unit power plant with a Warner clutch and a Warner transmission gearset. The clutch is a dry multiple disc type, the steel discs being alternately faced on either side with Raybestos. The clutch is said to be highly efficient and easy of engagement. The gearset is a selective sliding gear type, having three forward speed ratios and reverse. The shafts and gears are vanadium steel, the shafts being large and the gears having inch faces. The case is aluminum. The power plant is suspended at three points to protect it against the stresses of chassis distortion.

From the gearset the drive is through a main shaft that is in two sections, having three universal joints, one at either end and one in the centre. The rear end of the first section of the shaft is carried on a self-aligning ball bearing, and between this bearing and the rear axle are the centre and third universal joint,



Valve Side of the Continental Motor of the Unit Power Plant of the Acme Truck.

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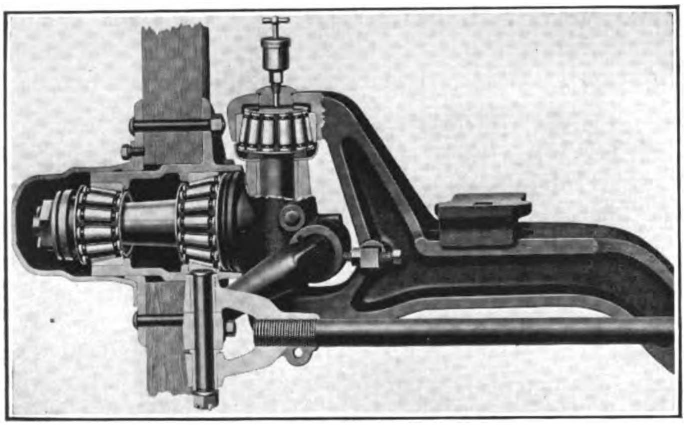


Construction of the Timken Roller Bearing Equipped Front Axle of the Acme Truck.

which construction prevents whipping and misalignment of the shaft.

The Front and Rear Axles.

The rear axle is a Timken-David Brown construction, this being a full-floating type. The axle housing consists of a central section, in which is mounted the differential assembly, and to which the end sections are bolted. The central section is covered with a plate which carries the mounting for the worm shaft and for the differential gearset that is supported by Timken roller bearings that are seated in the spiders. The worm shaft is mounted on Timken roller bearings that take the radial and thrust loads. By removing the cover the differential assembly may be removed from the housing as a unit without changing the adjustment. The differential gearset is a bevel gear and pinion type. The wheels are mounted on Timken roller bearings that are fitted to heavy sleeves that extend into the end sections of the housing nearly to the spring seats and through which the driving shafts are carried to the wheel hubs. The axle shafts are forged with the wheel clutch plates integral. The gear ratio is 7¾:1.

The forward axle is a Timken I beam construction with heavy steering knuckles, the wheel spindles and the knuckle pivots being equipped with Timken roller bearings. The web of the axle is 2¾ inches by 7/16-inch, with a two-inch flange. The wheels are a wood artillery type, with two-inch spokes in the front set and 2½-inch spokes in the rear set. These are fitted with 36 by four-inch solid band tires forward and 36 by six-inch single bands, or 36 by 3½-inch dual tires at the rear as desired.

Other Chassis Details.

The frame is a Smith production of heat treated pressed steel channel section, strongly gusseted and reinforced, and this is suspended on semi-elliptic Detroit springs, self-lubricating and fitted with bronze eye bushings. The top leaves of the rear springs are a special alloy steel to take the driving and torque stresses, for no radius rods are used. The service and emergency brakes are internal expanding within drums 16 inches diameter on the rear wheels, these having large surface area that is adequate for efficient braking in any operating condition. The steering gear is an irreversible worm and gear type that is operated from the left side by a large hand wheel. The control is by the conventional foot clutch and service brake pedals, a hand lever on the steering wheel and the gear shifting and the emergency brake levers in the centre of the footboard.

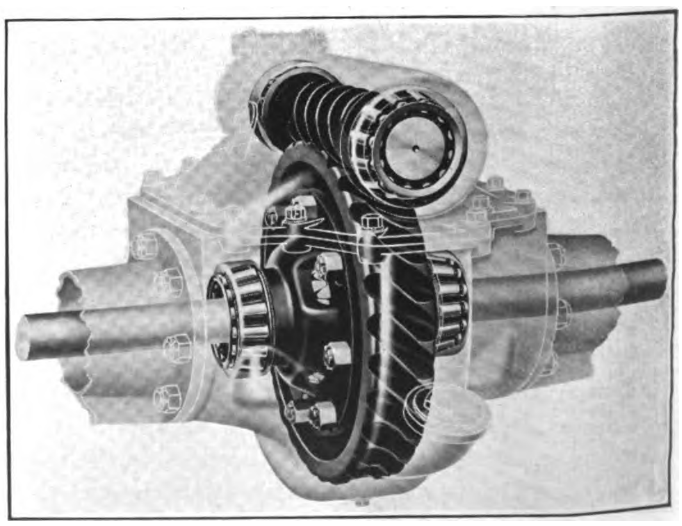
The wheelbase is 148 inches, the chassis length is 217½ inches and the loading space is 128 inches. The tread is 58½ inches. The gasoline capacity is 25 gallons, the tank being located under the driver's seat. The chassis is sold with equipment, including the driver's seat, three lamps, horn, jack and tools, for $2000.

WILLIAM C. ANDREWS DEAD.

William Claflin Andrews, advertising manager for the Edison Storage Battery Company, Orange, N. J., died in New York City, Dec. 21. A graduate of Columbia university, Mr. Andrews afterward became sales engineer of the Stanley Instrument Company of Great Barrington, Mass., and later became connected with the General Electric Company in Schenectady, N. Y., and Harrison, N. J. He was for two years secretary of the Rae company, New York City, leaving to join the Edison Storage Battery Company in April, 1913, where he was advertising manager until his death. Mr. Andrews enjoyed an unusually large acquaintance among electrical men and was particularly active in the Electric Vehicle Association of America and in the Jovian League, of which he was statesman-at-large for New Jersey.

FREIGHT CAR SHORTAGE FELT.

With nearly 65,000 cars loaded with freight for export tied up near New York, Detroit motor car and truck makers have been feeling the pinch of a car shortage. Traffic men have been fighting hard for cars for several weeks, which have been getting scarcer all the time.



Phantom View of the Worm Shaft, Worm Wheel and Differential of the Timken-David Brown Rear Axle.

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ROAD BUILDERS' YEARLY CONVENTION.

The 13th annual convention of the American Road Builders' Association, the sixth American Good Roads Congress and the seventh National Good Roads Show will all be held simultaneously in Pittsburg, Feb. 28, 29 and March 1, 2, 3.

Both the meetings of the organizations and the display of machinery, tools and materials which make up the show, will be held in Mechanical hall. The formal opening of the show will take place Monday evening, Feb. 28.

The city of Pittsburg recently appropriated $15,000 for the purpose of putting the hall in condition, the improvements including a complete heating plant and a concrete floor. The building is owned by the city and is situated in the point district, at the junction of the Allegheny and Monongahela rivers. Railroad sidings will make the installation of the heavy machinery exhibits comparatively easy work.

SALESMEN AND PUBLICITY MEN.

In a talk to the salesmen of the R. E. Taylor Corporation, which distributes Garford trucks in the metropolitan territory, Putnam Drew, publicity manager, recently declared that a publicity man was absolutely dependent for his success on enlisting the cooperation of salesmen.

He said that the advertiser must know what prospects were thinking and feeling about a product, and that his only access to those facts was through the salesman who comes in daily contact with prospects. The salesman he described as a publicity man who depends on word of mouth publicity, while the publicity man works with the same material in the written form. The two should work together, co-operating for the benefit of the common employer.

WILL DISPLAY OILLESS BEARINGS.

Bearings in which a rotating shaft will be turned at maintained speed and under load without oil or other lubricant will be displayed at the New York automobile show by the Dann Spring Insert Company, which recently began to market a new bearing composition called Amalgamite, for which remarkable qualities are claimed. Spring eye bushings of the same material will also be demonstrated. Great interest has been created in the new metal, which a number of railroads are said to be testing in service for bearings.

A new tire to be known as Usco is to be launched by the United States Tire Company after the first of the year. The new tire is a product of the company's experimental department. It was first proposed to call it Union Tread by reason of the ingenious union that has been effected between the rubber and the fabric of the tire.

GERMAN GASOLINE SUPPLY.

Belief that Sufficient for Military Requirements Is Available.

Estimates of the supplies of petroleum that are available for use by the Germans indicate that throughout the war a very considerable amount has been supplied to them.

Engineer Guiselin, secretary of the International Commission on Petroleum, has recently made public in Paris an estimate of these supplies. Before the war there were large stocks in storage in Germany and the Germans have been able to use the products of the fields in Roumania, Alsace and Hanover, and with the exception of the time during which the Russians occupied Galicia—of the Galician fields as well.

Before the war Galicia was producing 72,000 tons a month and during the early months of the war this was increased to 89,000 tons. The Russians are known to have destroyed 229 wells during their occupation, but many were not destroyed and those put out of commission have doubtless long ago been restored.

Roumanian exportations of petroleum in 1914 amounted to a million tons. A large amount of the capital employed in the operation of the Roumanian fields is German. Germany is the third consumer of petroleum in Europe and before the war was taking about 120,000,000 tons annually.

Roumania has enforced a decree forbidding the exportation of those parts of the crude which can be used for motor spirits or the lighter oils. The figures indicate that while Germany has been inconvenienced by the shortage of the supply and has been forced to develop intensively the wells in her field of influence, she has still in all probability been able to get whatever she needed for her army.

TRUCKS BEST IN BIG STORM.

The snow storm that buried New York City about the middle of December demonstrated to business men the superiority of motor trucks over horse drawn vehicles under severe conditions. Most of the horse drawn vehicles took only half of the usual loads and were forced to follow the car tracks or use streets from which the snow had been removed. In most cases trucks took full loads and covered the usual routes without difficulty.

EXPORTERS NEED AMERICAN OFFICES.

To care for the demand for American goods for export, which has grown greatly of late, several firms of English exporters have recently established offices in New York to do their buying and see that the goods are shipped promptly. They are also being shipped directly to foreign customers instead of going through the headquarters in London.

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TRUCK HAULED 21 TONS.

Big Milling Machine Transported at Packard Factory on Special "Float".

The actual capacity for haulage of the average motor truck is seldom realized, even by those who are constantly using these machines. The supposition is that very large horsepower is necessary to haul capacity loads in ordinary operating conditions, but as a matter of fact there is really no need of anything like the power the engines will develop but a very small part of the service time.

Generally speaking, a truck engine is credited with power to haul twice the rated load capacity of the vehicle unless on very steep grades. This estimate is very liberal and when operated efficiently there is reason to believe that a machine can pull a considerably greater ratio of load.

This belief is borne out by work now being done by the Packard Motor Car Company in connection with the expansion of its factory. As the new building units are completed they are equipped with machinery, some of which is removed from old shops. To move some of the largest tools a special vehicle was constructed, which moves on extra large motor truck wheels, having axles proportionate and a platform made of 12-inch channel steel section frame with heavy oak deck. On the forward end is anchored a winch by which the machines are loaded.

Milling Machine Weighing 21 Tons Hauled on a Special "Float" by a Packard Four-Ton Worm-Driven Truck at Factory.

This is drawn by a four-ton chainless truck that has winch equipment, so the load may be moved through narrow places. On straight ways the truck does the hauling, usually at rates from three to four miles an hour. In the illustration the truck is shown hauling a burden of more than three times its loaded weight. This load was started several times on differing paving, and the only difficulty met with was maintaining a perfect balance, which precluded faster haulage. The tool shown on the "float" is a special crank case milling machine that weighs more than 21 tons.

INVESTIGATE STOLEN CAR NUMBERS.

The system of stealing automobiles which has developed in all parts of the country depends on the fact that the motor and car numbers can be changed with a chisel and the car registered under a false number. A bill is to be presented to the Massachusetts Legislature which will require an investigation of the authenticity of every car number before the car be registered and used. This investigation would bring to light the car's history and aid immeasurably in capturing car thieves. The only doubtful part about the law is the possibility of making the investigations at reasonable expense.

BIG FUTURE FOR ELECTRIC TAXI.

One of the electric taxi-cabs which have been used very successfully in Detroit was shown at a recent meeting of the Electric Vehicle Association of America in New York, and numerous engineers who examined it predicted that such cabs would soon be used extensively in all the larger cities of the country.

E. W. Curtis, Jr., of the General Vehicle Company, who recently returned from London, England, gave a very interesting talk on electric vehicle conditions in Europe at the meeting. S. C. Harris, storage battery expert of the New York Edison Company, read a paper on "Methods of Design and Operation Which Assure the Efficiency of the Electric Vehicle." He advanced many novel ideas, based on his practical experience. The paper was warmly discussed by a number of electrical engineers.

The Yankee Farm Tractor Company has been formed in Springfield, Mass., with a capitalization of $50,000. The following are the officers of the company: Dr. Ernest R. Pendleton, president; William H. Hosmer, Jr., of Springfield, clerk, and Fred Schmidt, treasurer. A number of Springfield capitalists are interested in the undertaking.

The plant of the French Battery and Carbon Company, 120 South Dickenson street, Madison, Wis., was destroyed by fire Dec. 1, with a loss of $100,000. The plant will be rebuilt.

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ELECTRIC VEHICLE PRACTISE.

Regulation of Motor Speed by the Controller or Switch—Standard Types that Are Hand-Operated—The Continuous Torque Characteristic—The Segment Layouts of the Typical General Electric Designs and the Combinations Obtained in Them.

By William W. Scott.

MOVEMENT of an electric vehicle either forward or backward must be governed or regulated to obtain the differing degrees of speed and power necessary in the work to be done. The battery, which has been explained in some of the preceding articles, is, when charged, the source from which the energy is drawn, and the motor or motors transform this energy into mechanical power by which the traction wheels are turned.

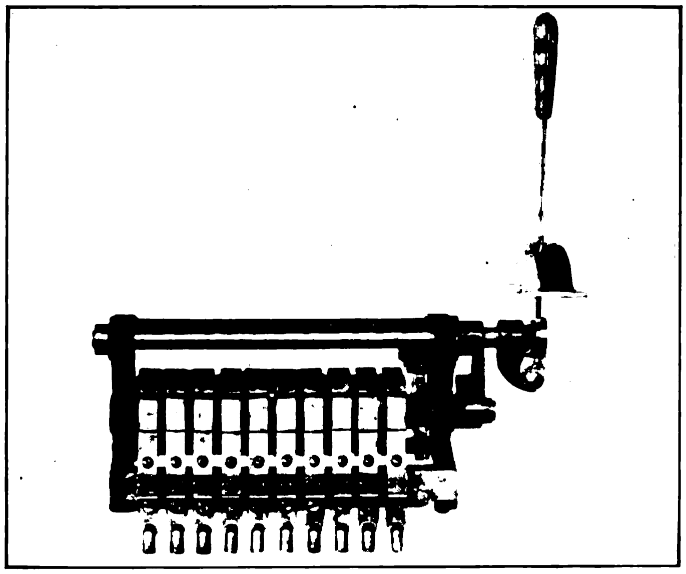
Generally speaking, the highways on which vehicles are driven may be divided into three classifications which are approximately equal, and these are ascending grades, descending grades and levels. That is to say, that a third of the distance a machine is driven it will require comparatively little propelling power, for another third there will be required what may be regarded as normal propulsive effort, and for the other third the greatest use of power, varying, of course, with the degree of the ascent, the character of the surface, the weight of the load and the mechanical condition of the vehicle.

There is a definite value of energy in a battery of a pleasure car or truck when it is charged, and this only is available for power. The battery is always given what is known as a capacity rating by the manufacturer, and this is based on the number of ampere hours. The lead-acid battery cell is estimated to have a voltage range of from 2.5 maximum to 1.8 minimum, and the nickel-iron-alkaline cell a voltage range from 1.8 maximum to 1.2 minimum. The ampere-hours capacity depends upon the size of the cell in either case and upon the area of active material of the plates in contact with the electrolyte.

Obviously the battery voltage is variable with the number of cells, and it may be from 16 to 44 in common practise with lead-acid cells and from 20 to 60 with nickel-iron-alkaline cells, the maximum of 44 and 60 being generally established by the use of 110-volt circuits from which charging may be done. The size of the cell is determined ordinarily with reference to the work for which the vehicle is intended.

The electric vehicle differs from any other in that if it is functioning normally it will only absorb the value of energy that is necessary to do the work. By this is meant that when driven with good judgment it will descend grades with very little if any consumption of power. When driven on levels it will draw upon the battery for the power required to maintain the speed determined by the driver, and when ascending grades it will absorb a definite value of current up to the maximum, but its speed will lessen as the work is increased.

This statement applies to the use of series-wound motors, but in the event of need, as in starting in sand, mud or snow, or climbing a very steep grade, a very large overload of the motor can be used for a brief period. The average motor can be used with an overload as high as 300 per cent. for a limited length of time, and usually the limitation as to time is established by the manufacturer so that, for instance, if 50 per cent. is permissible for an hour, this might be increased to 100 per cent. for a half hour, and to 200 per cent. for 15 minutes, and to even a greater percentage for a correspondingly decreased period. The limitation of overload is temperature, for the motor ought not to be heated to a point that is dangerous to the insulation, which would, if damaged, probably result in short circuits and failure.



A General Electric Standard Drum-Type Continuous Torque Hand-Operated Controller or Switch.

The working radius of the electric machine is usually established by the builder on the basis of mileage that can be depended upon with a single battery charge, and this is accepted as carrying a full load the entire distance with a passenger car and carrying a full load half the stated number of miles, or half the load the full number of miles, or any ratio of load to miles

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that will correspond to the first statement, with a freight vehicle. The mileage rating with any given machine is based on the standard capacity of the lead-acid battery given by the battery manufacturer, which must diminish gradually with service, but when based on the nickel-iron-alkaline cell there will be no diminution with normal care for a period of four years or more.

If, for instance, the battery should have a rated capacity of 325 ampere hours for energy, and the manufacturer of a vehicle should rate a vehicle at 50 miles on a battery charge, this would be basis for assumption that the average value of current necessary to operate it would be six ampere-hours a mile, with a reasonable margin for emergencies. Without a load the machine could be operated with an average of considerably less

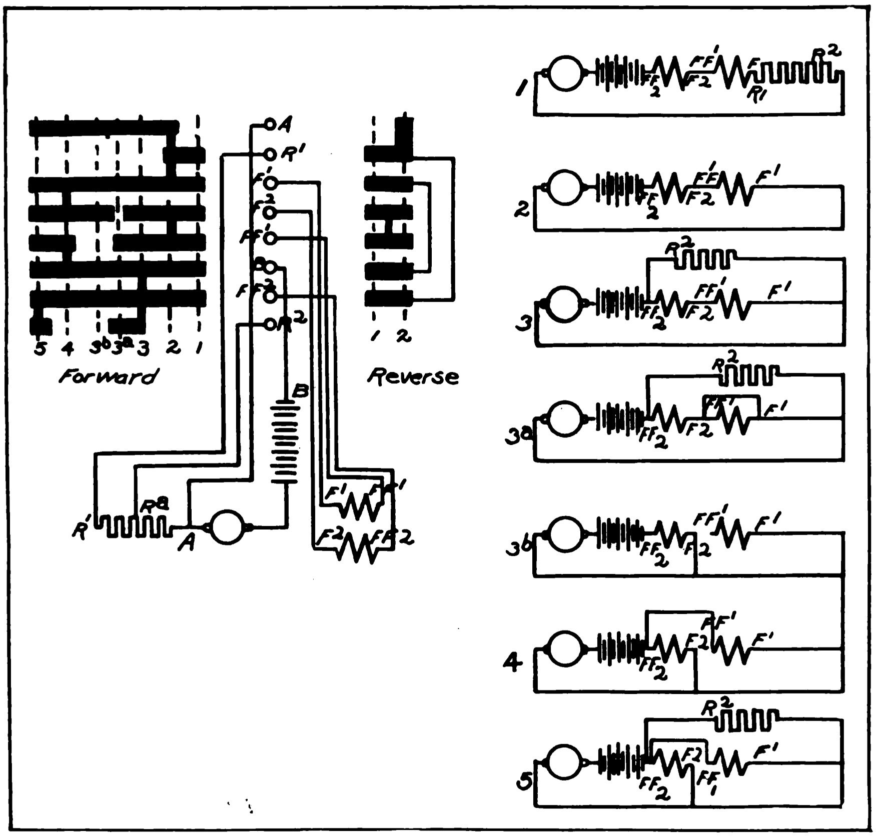

Diagram of the Layout of a General Electric Controller Affording Seven Speeds Forward and Three in Reverse with the Battery in Series.

than six ampere-hours a mile, and loaded the requirement would correspondingly exceed that figure. If the work is variable as to mileage, the condition of the roads traversed and to loads, there would be varying current required. There will not, however, be more current absorbed than the work needed unless through some defective mechanical condition, which would be evident upon comparison of mileage and charging records.

The electric vehicle is not intended to be fast, although specially designed machines have proven to have remarkable speed, for this would require large power consumption, and this in turn means expense. To the contrary it is designed to be economical, and this means minimum demand for current. The motor will absorb whatever current is necessary to perform a given work and this means with reference to the conditions in which the machine is being used.

The characteristics of motors have been stated, but at this point it will be well to reiterate that the series-wound motor, which is generally used for electric vehicles, must be used with a load, for otherwise it will increase its speed to the point of destruction through velocity. But with the load it is, broadly speaking, self-regulating. As the power of the motor is obtained through the revolutions of the armature, which must be started from rest, these are gradually increased, and the effect may be likened to that of the expansion effort in a steam engine, for with the means of reduction in the power transmission system the inertia of the vehicle is overcome by increasing pressure or leverage instead of by the abrupt application of energy as in the internal combustion engine.

The starting of a motor is accomplished by gradually supplying the current, for the following reasons: When a motor of any size is at rest its armature has very low resistance to flow of current, and an excessive and possibly a damaging current would flow through it were it connected across the supply or power wires while at rest. The current must, therefore, be reduced to what is safe for starting, and this is done by the introduction of resistance into the circuit, which is known as the starting resistance. The control of this resistance is so arranged that after the motor is started it may be gradually reduced or "cut out," and when the motor has been brought to speed the full voltage may be brought across the armature.

The reason why a current that would be destructive of an armature when the motor is at rest will not damage it when running is very simple. As the armature revolves the windings are cutting through a strong magnetic field and sets up a voltage in the armature, just as a voltage is set up in a generator. This voltage is always in a direction opposite to the current that is driving the motor, and this limits the flow of current. This voltage is known as the counter electromotive force. The voltage of the current through a revolving armature is not the line voltage, but is the voltage of the line minus the back voltage in the armature. This may be expressed in the following formula:

$$\text{Current (through armature)} = \frac{\text{line volts—back volts}}{\text{resistance of armature}}$$

But when the armature is at rest there is no back voltage, and the full strength of the current flows through the armature unless there is sufficient resist

ance placed in series to reduce the current to a point of safety.

As an example, the resistance of the armature of a two-horsepower motor may be assumed to be 0.4 ohms. Were this motor at rest and the voltage of a 110-volt line thrown across the armature, the load would be very greatly increased, as may be seen from the following:

$$\text{Amperes (through armature)} = \frac{\text{volts, (across armature)}}{\text{ohms (of armature)}} = \frac{110}{0.4} = 275 \text{ amperes}$$

This current would be sufficient to destroy the insulation and melt the copper of the wiring and the commutator.

Assuming that when this motor is driven at normal speed it has a counter electro motive force of 103 volts, the current that would then flow across the armature may be found in the following manner:

$$\text{Amperes (through armature)} = \frac{\text{line volts} - \text{back volts (across armature)}}{\text{ohms (of armature)}} = \frac{110 - 103}{0.4} = \frac{7}{0.4} = 17.5 \text{ amperes}$$

The determination of the resistance that shall be used to operate the motor with safety, assuming that the current that shall be normal is 18 amperes, and that the current shall not exceed this more than 1.25 per cent. in starting, is obtained in the following manner:

$$\text{Starting current} = 1.25 \times 18 = 22.5 \text{ amperes}$$

$$\text{Resistance (of combination)} = \frac{\text{volts (of combination)}}{\text{amperes (of combination)}} = \frac{110}{22.5} = 4.89 \text{ ohms}$$

But as the resistance of the armature is 0.4 ohms, this is deducted from the value found, which gives a necessary resistance of 4.49 ohms. This will be sufficient to amply protect the armature and reduce the initial starting current from 275 amperes to 22.5.

We know that the motor will, through the generation of counter electromotive force, take the full line voltage after it has been started, and then the resistance can be removed or "cut out." This means that the machine is gradually started for its own protection, but this easy acceleration equally protects all the machinery coupled with the motor. The steps or graduations of the resistance may be whatever is necessary. The changes are made with sufficient time for the motor to reach the maximum speed with each step or grade, for if the "cutting out" is done too rapidly the motor will not be up to the speed that will generate the required counter electromotive force to oppose the flow of current and the motor will be overloaded. If all the resistance is not "cut out" the motor will be driven at reduced voltage and at less speed. Here may be stated the principle that with a given load a series wound motor draws the same current irrespective of the speed, and for a given load the speed varies directly as the voltage. The speed at a given load may be varied by varying the resistance placed in series in the circuit of a series wound motor, but if the load on the motor is constant the current drawn will be constant regardless of the speed.

If, however, the resistance is placed in parallel with the field of a series wound motor the speed will be increased with a given load instead of decreased. This is known as shunting the field of a motor. This shunt would never be applied until the motor has been brought to normal speed by cutting out the starting resistance. With a shunted field the motor is driving a load at a speed higher than normal and for that reason requires a correspondingly increased current. If a resistance is placed in parallel with the armature of a series wound motor it will operate at less than normal speed when all the starting resistance has been cut out. This connection is what is known as a "shunted armature" and is used where a low speed is desired with a light load.

The possibilities of regulation by design—by resistance and by wiring—are evident enough, but these are not sufficient, and further control is obtained by grouping the cells of the battery. If a number of cells are connected by wiring joining the unlike poles, that is—positive to negative—the end cells having one positive and one negative terminal open for connection in a circuit, the cells are said to be in series, and they will have a voltage equal to the voltage of one cell multiplied by the number of cells, and the amperage represented by the amperage of any one cell. For example, 10 cells would have a maximum voltage of 25 volts, and let us say an amperage of 225.

If, however, these cells were coupled by wires connected on one side to the negative terminals and on the other to the positive terminals, with these wires extended beyond either end cell, the circuit would have the voltage of but one cell, but it would have the total amperage of 10 cells, or 2250 amperes. This combination is known as parallel, or is sometimes referred to as multiple. This has one negative and one positive wire.

When there is desire to increase both the voltage and the amperage, the cells are divided into groups, the number of groups depending upon the character of the service and the control. The cells are first connected in series, groups or sets, so that when required the combined voltage of all is available. Each group or set affords a given voltage, and when these groups are connected in multiple, by coupling the end negative and the end positive terminals together, this gives the voltage of one group and the amperage of one cell multiplied by the number of groups. This is known as the series-parallel combination.

The controllers used with electric vehicles vary considerably in design and construction, but they are all a type of switch by which certain current values are supplied to the motors. To describe these individually would serve no useful purpose, but there is every reason to explain the principle of operation of the form that is now generally used. Here statement should be

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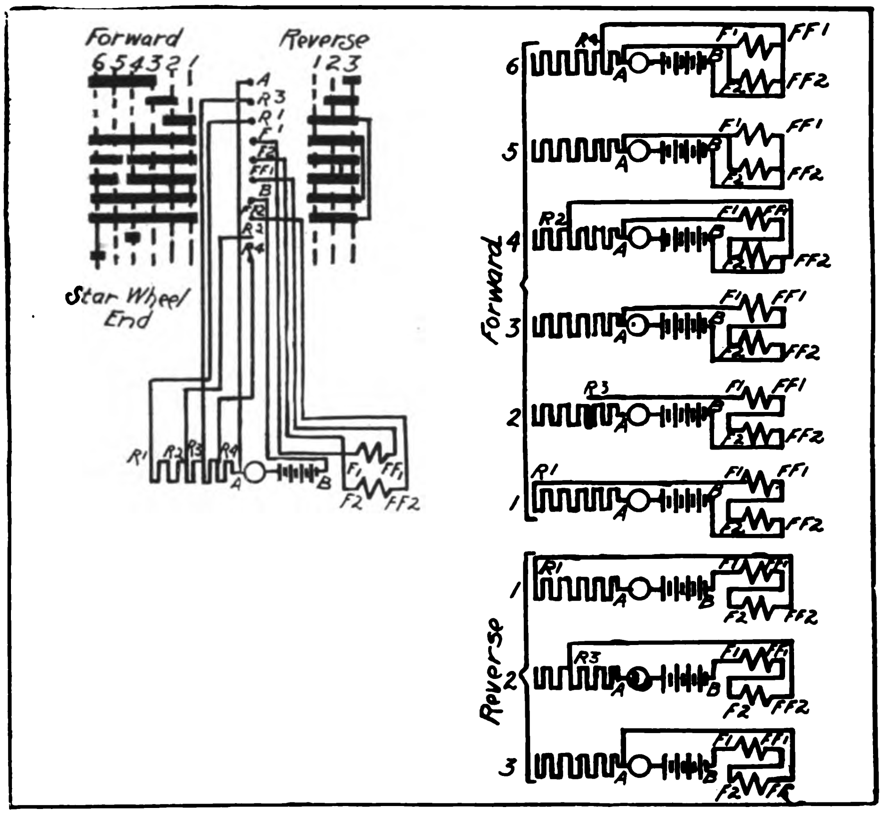
made that with all electric wagon or truck controllers the regulation is made by the use of wiring and resistance, but in some pleasure cars the batteries are grouped as described above and lessened voltage and increased amperage obtained by commutation of the batteries. The controller also affords a means of reversing the motor by reversing the relative position, the polarities, of the connecting leads from the battery.

The controllers in use are practically all known as continuous torque types, by which is meant that there is no interruption of the current during the changes from one position to another, this obviating variation of motor power and sparking and insuring an even movement of the machine. In conventional practise the controller consists essentially of a cylinder mounted on an axis that is operated by a hand lever. On this cylinder is a series of metal blocks, well insulated, which contact with a series of metal fingers that are mounted on a base to which terminals are attached. By turning the cylinder different combinations are obtained, which vary in number with the length and diameter of the controller drum and the special requirements of the vehicle in which it is used.



Another General Electric Drum Type Controller Segment Layout, This Being for Pleasure Cars and Having Six Speeds Forward and Three in Reverse.

Electric vehicles are driven by one, two and four motors, and with these the controllers will differ somewhat in design, although the same principles will apply. The majority of electric machines, however, are equipped with but one motor, and the statements made will apply to this form of equipment because of the probability of confusion of a number of different constructions. Generally speaking, the value of the current supplied to the motor is obtained by decreasing the resistance in series with the armature and by successive degrees of motor field strength. The controller may be either hand lever or foot pedal operated, this depending upon the purpose of the designer. The location may be under the driver's seat, beneath the footboard, at the base of the steering column, beneath a hood or in a compartment, the purpose being to protect it so far as possible and yet have it easily accessible. There is another type in which a small lever or dial is turned, and this actuates the movement of a series of plunger electromagnets that open and close the connections between the motor, battery and resistance.

The greater number of controllers in service are what are known as the drum type, to which reference has been made. This drum is generally a segment of a cylinder that carries the copper contact blocks, and on the base are mounted the copper contact fingers, to which are connected the leads from the motor, battery and resistance. There is a neutral position for the cylinder in which there are no contacts and no current can flow from one circuit to another. As the lever is moved the connections are progressively made between the motor armature and its fields, the battery and the resistance.

In the first position high starting torque and low speed are obtained, which insures that the vehicle will be moved slowly and easily, and there will be sufficient power to carry the machine out of sand, mud, snow, on rough or steep surfaces, and the fields of the motor are then connected in series with each other and with the armature. But resistance is included in the circuit so that the motor will start smoothly and slowly. In the second position the resistance in series with the motor is lessened, and in the third position the resistance is "cut out" entirely. In the fourth step or position the fields are connected in parallel with some resistance, and the fifth and succeeding positions will weaken the field strength. This statement assumes that the cells were arranged in series, which is the design of all General Electric controllers save in one or two instances, and is general with all trucks and wagons, but some of the passenger car controllers are built for grouping the battery cells in parallel, there being from two to four groups, according to the purposes of the manufacturer.

When cells are grouped in parallel in three groups, so that the start may be made with half the battery voltage capacity and resistance, the second and third groups are connected progressively. The start is

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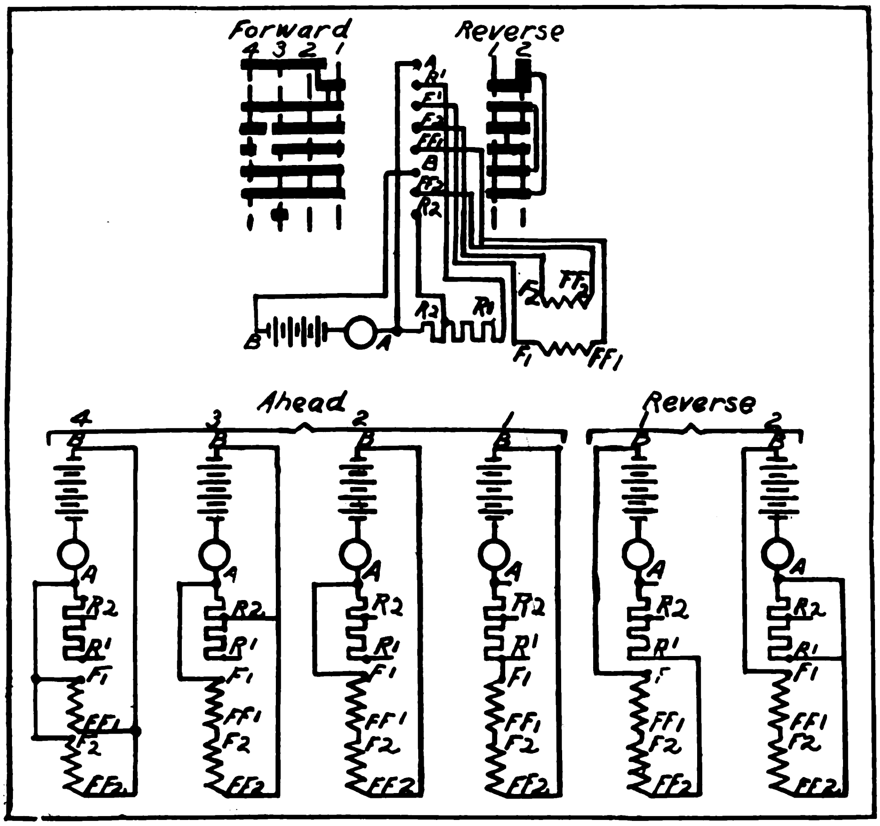
made with resistance and this is gradually reduced as the different positions are reached. The motor combinations are generally the same as those referred to for the series power connections. By combinations of positions, weakening the motor field, decreasing the external resistance and increasing the voltage from the battery varying degrees of control can be obtained. As many as 10 different positions for forward movement are practical, and with these a gearset may be used that will afford even greater variance of speed, according to the requirements of the conditions of operation.

Considering the standard General Electric controller for electric vehicles, this is fitted with a gear and sector, the sector having attached to it a handle that is operated in a guide plate that is notched for forward and reverse positions. This type of controller can be developed for differing numbers of speeds forward and in reverse by lengthening the cylinder and increasing the amount of angular displacement of the handle. In standard practice for pleasure cars six forward speeds and three reverse speeds have been found to afford satisfactory operating conditions, while for trucks four forward and two reverse speeds are generally sufficient where the maximum driving speeds do not exceed from 15 to 18 miles an hour.

The type that is illustrated is S-103, which is so designed that by changing the overall length, the cylinder contact arrangement and the number of contact fingers, it can be readily adapted to the various connections required. The cylinders are of uniform diameter and are held between frames of standard design. The movement of the cylinder is by means of a gear on the shaft that is actuated by the sector on which the handle is mounted. This form of gear reduction greatly reduces the angle through which the handle moves in comparison with the movement of the controller cylinder. This facilitates the operation of the controller from the driver's seat. These controllers are designed to be mounted with the finger bases directed toward the floors of the machines, as with this construction the leads may be extended upward and are easily accessible and are quickly removable.

Taking as an example for illustrating the continuous torque obtained with a standard General Electric controller, a type having seven forward speeds and two in reverse, the special feature of the construction is shown by a segment layout. To secure smooth acceleration the current must flow uninterruptedly while the cylinder is passing to the different positions or notches. In this system of control the interruption will take place only in the transition from the series to the series parallel point on the controller. The different speeds are obtained by the introduction of series in the circuit or by shunting the fields. Referring to this particular point the continuous torque is applied as indicated on this layout in the following manner:

On the third position the motor fields are in series and shunted with the resistance R2. As the controller passes between positions 3 and 4, the 3A short circuit is introduced around one set of fields. Referring to the segment layout, the reader will note that this short circuit is introduced by the contact finger dropping across the gap on the contacts F2, connecting them to F1 and FF1. In the next position, 3B, the shunt R2 is removed. The field connection FF1 is open, leaving the field terminal F2 connected to the line F1. Referring again to the contact finger, F2 has now passed across the gap.



Typical Segment Layout for a General Electric Truck Controller Having Four Forward Speeds and Two in Reverse, with the Battery in Series.

On the next point or position, the fourth in the layout, the terminal FF1 is connected to FF2.

Reviewing this to accomplish the changes required, the resistance is first introduced across the series field after which one set of field coils is short-circuited, the other field remaining in full strength. The connection of the resistance and the short-circuited field is now broken, after which the previously short-circuited fields are placed in multiple with the others. Although during the transition only one set of fields are used, experience has shown that on a four-pole motor, with sets of field coils 180 degrees apart, there is very little momentary increase in oper-

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ating current. This explanation in question applies to a single motor equipment. For a double motor equipment the general scheme will be the same, except that instead of one motor with series parallel fields the two motors would be in series, which would be placed in series parallel. In all General Electric systems of continuous torque control, except in one or two special types, the batteries are kept in series at all times. Referring to the layout, one will note that the bateries are indicated by one terminal that is marked "B," and another terminal that is connected to the armature.

Two other layouts are given for the purpose of illustrating the same general principle of operation, the one with six forward speeds and three speeds in reverse, for pleasure car service, and the other with four forward speeds and two speeds in reverse, for truck equipment. Referring to the former, on the first position the motor and batteries are in series with all of the resistance; on the second the motor and batteries are in series with a part of the resistance; on the third the motor and the batteries are in series without resistance; on the fourth a part of the resistance is shunted across the field windings; on the fifth the field windings are connected in multiple, and at the sixth the field windings are connected in multiple with a small part of the resistance shunted around them. For the three reverse speeds resistance control is applied.

Referring to the truck controller layout, in the first position the motor and the battery are in series with all of the resistance; in the second the motor and batteries are in series with a part of the resistance; in the third a part of the resistance is shunted across the field windings, which are still in series, and in the fourth the field windings are connected in multiple. As in the pleasure car control, the two speeds in reverse are regulated by the use of varying resistance.

By the application of this principle the circuit is not interrupted at any time during the transmission from the first to the maximum point, which prevents any rush of current such as might follow if the circuit were open. This continuous torque provision is applied at the point where the fields in single motor equipment are shifted from series parallel, or in two-motor equipment where the motors are shifted from series to parallel.

For special service, where there will be abnormal moisture, and where conditions require completely enclosing the controller, a type has been constructed that has a drum covering, and which, in the same manner as applies to the open controller, can be developed the standard number of speeds forward and reverse, and with different current carrying capacity.

With these controllers the resistance is a cast grid type, either iron or aluminum, in size to have the ampere capacity required for the service and the metal is copper plated to protect it from rusting, and painted with aluminum paint.

(To Be Continued.)

CONCRETE TRUCK BODIES.

Shortage of steel has set the experimental department of one truck manufacturer at work on the idea of a cement concrete body for the trucks which the concern is shipping in quantity for service of the European armies.

The concrete is made by mixing steel findings and chips with the cement. The bodies are cast in slabs with riveting or bolting holes in them. They can be assembled quickly on the battle fields. As the average life of a truck in the war is only nine days, the question of durability has not yet been settled. The company is also undecided regarding the adoption of the material for other uses.

HIGHWAY ENGINEERING AT COLUMBIA.

To give men who are university graduates and are employed in road work a chance to get an M. A. degree in highway engineering, Columbia university has arranged a special course of instruction in subjects connected with that work to be given from December to March. This is equivalent to half a year's residence at the university and as a full year is required for a master's degree, two such periods are required. The instruction covers every phase of road construction, as well as the chemistry of road materials.

NEW FISK PUBLICITY MANAGER.

George B. Hendrick of Winthrop, Mass., has been appointed manager of a newly created department of publicity for the Fisk Tire Company of Chicopee Falls, Mass. He has been advertising manager of the Boston Traveller, the Pittsburg Post and Sun, sales manager of the A. Mugford Corporation of Hartford and the George H. Ellis Company of Boston. He goes to the Fisk company from the latter concern. In addition to publicity he will have charge of all printing and will edit the company's house organ.

TRUCKS AID BIG POSTOFFICE RUSH.

The Christmas rush of mail and parcel post packages was met in most cities by the use of extra automobile trucks, which the postmasters rented in large numbers to take care of their deliveries. In no year since the establishment of the parcels post has so large a volume of matter been handled. In many cities the regular motor truck equipment proved very efficient and the addition of more motors greatly increased that efficiency.

J. L. Barabas, who has been with the International Harvester Company of America for a long time, has been placed in charge of the company's sales rooms in Chicago as general manager.

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PRACTICAL MOTOR TRUCK MECHANICS.

COOLING A QUICK HEATING ENGINE.

The cooling systems of recent built trucks cause little if any trouble, but those of some of the earlier machines are such that overheating will frequently happen. A condition where a truck engine constantly overheated was changed to thorough cooling by a clever mechanic. The engine was under the seat. To make the change, which is shown at Fig. 45, a tinsmith made two ventilators, illustrated at B, and fitted them to a flange so that they could be turned. A hole was bored at either side and well to the front of the machine and the ventilators fitted as at A. Small brackets were attached to the sides of the seat so the funnel shaped ventilators could be locked. Deflectors were then attached inside the seat so that the air currents were directed to the engine. It is obvious that in rainy weather water and moisture might find its way to the engine, but this condition was obviated by reversing the positions of the ventilators, as shown at C.

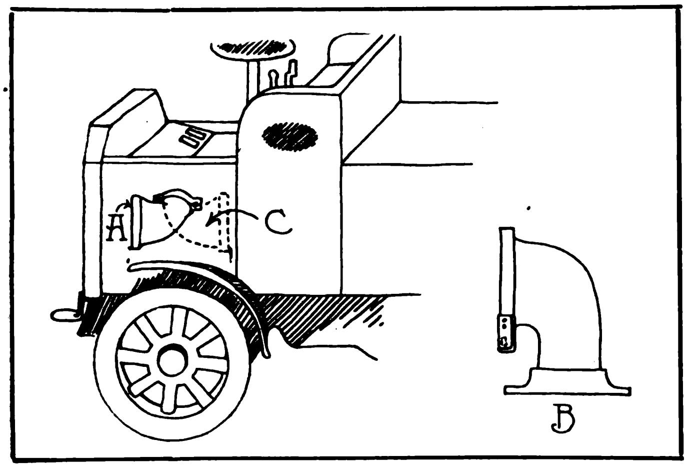

Fig. 45—A, Engine Ventilator to Prevent Overheating; B, the Ventilator Flange; C, Ventilator Turned to Keep Motor Dry.

WHY PEDALS WEAR SHOES.

Motorists who do considerable driving in crowded traffic, naturally operate the clutch and brake pedals more than the average driver, and the continual rubbing of metal and the soles of the shoes will quickly wear the leather. Caster oil applied to leather soles will soften them and add greatly to their wearing qualities and better convenience the driver. The soft sole shoe is much to be preferred to the heavy sole, as with the thin and flexible leather the operator can "feel" the pedals. The soles of new shoes can be treated, increasing their endurance and your comfort.

REPLACING PISTON RINGS.

Much difficulty is frequently experienced in replacing large piston rings in engine cylinders. There are many methods which may be resorted to in such an event, but a very simple and practical one is to compress the rings tightly on the piston and encircle each with a piece of soft wire. The wire should be twisted so as to hold the ring in its proper position. The cylinder is then slid over the piston, readily pushing the wires into the crankcase, from which they can be easily removed.

RESTORING BRAKE EFFICIENCY.

Not infrequently after much use the brake drum of a wheel will become so highly polished as to reduce the efficiency of the brake. This condition may be easily remedied by cutting grooves about 1/16-inch in depth across the drum. These grooves can best be cut with a three-cornered file and when carefully made they will not damage the brake lining. About three grooves on each drum will be sufficient.

STRAIGHTENING WATER PIPE KINK.

The rubber water pipes leading from the radiator to the cylinders frequently kink so badly at the point of bend that the water cannot flow by in a sufficient amount to provide an adequate cooling system. It is almost impossible to fully eliminate this kink, but a simple temporary relief is shown at Fig. 46 B. Fasten a metal clamp, such as is commonly used to retain the pipe to the radiator, on the pipe at the kink. This will provide adequate water passage.

SILENCING NOISY VALVES.

Though the valves of an engine may be enclosed in metal cages, the noise produced by them is objectionable. Metal tends to carry the sound rather than to silence it. A simple remedy is shown in Fig. 46 A. Cut a piece of cardboard to the shape of the side of the cover which faces the valves. The cardboard should be shallacked on both sides and then pressed firmly on the cover. Of course there must be a small hole in the centre to admit the retaining bolt.

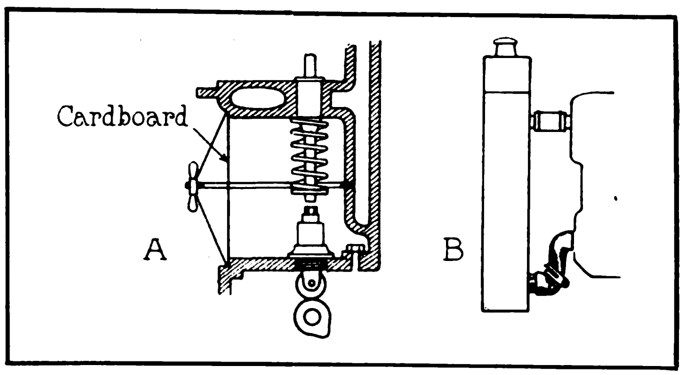

Fig. 46—A, Cardboard Inserted to Silence Noisy Valve; B, Clamp to Straighten Water Pipe Kink.

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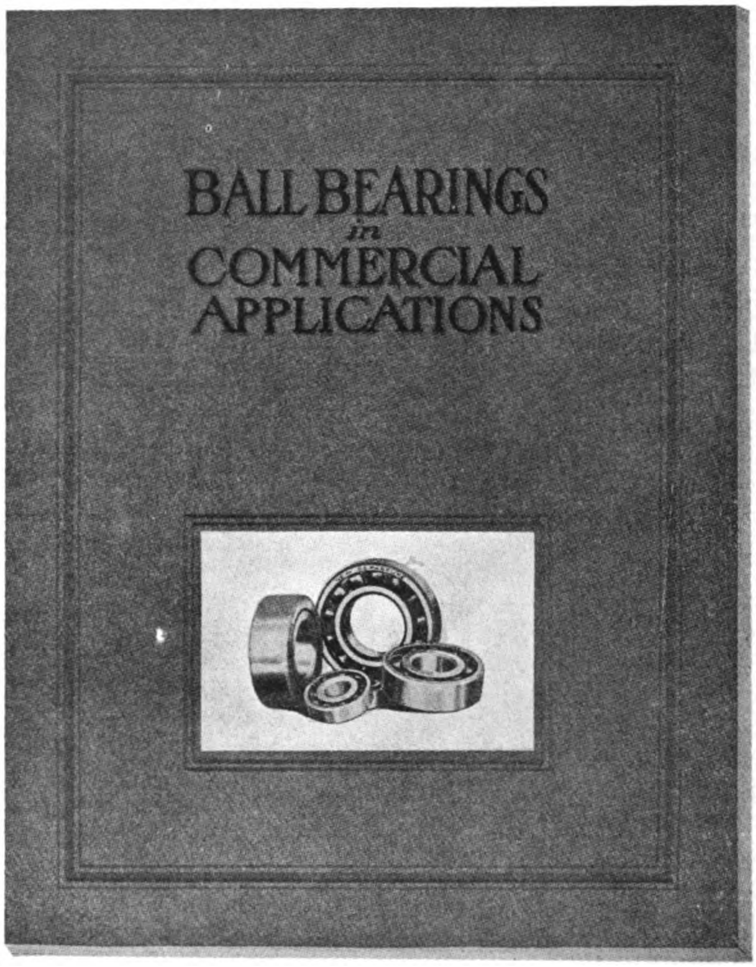
American Made for American Trade



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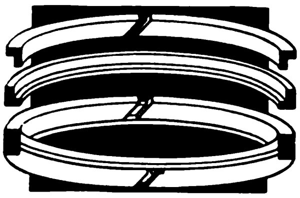
MOTOR TRUCK ACCESSORIES AND EQUIPMENT.

LEAK-PROOF RINGS.

The Leak-Proof ring is a patented two-piece concentric piston ring designed to insure perfect compression of the mix-



ture by sealing of all openings. Carbonization and black smoke are decreased by this type of ring because it keeps back the surplus oil. Leak-Proof piston rings are made in all sizes for automobile, truck, motorcycle, marine, tractor and stationary motors. At present these rings are giving satisfactory service in over 300,000 automobiles. They are moderately priced, but allow large profits to dealers and repair men. Widely advertised.

Manufactured by the McQuay-Norris Manufacturing Company, Dept. D, St. Louis, Mo. Price list supplied on request.

RE-FACING AND RE-SEATING TOOLS.

Valve grinding can be made easy if Bean re-facing and re-seating tools are first used to remove the carbon and unevenness of the valves and valve seats. The accompanying illustration shows a complete set of tools for re-facing valves up to 1¾ inches; three different size valve re-seaters, ranging from 1½ to 1¾ inches, and also the different size bushings for the re-facers and the different size pilots for the re-seaters. The valve

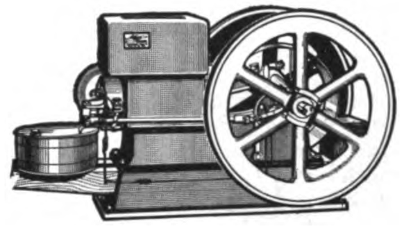
re-facer has a reversible frame supporting disc for grinding and also a disc with spiral cutters for tooling.

The maker also produces a special Ford size, a number of large sets as well as motorcycle outfits. The cutters are made of the finest steel and are tempered and accurately ground. This method insures the trueness of the valve and the valve seat and allows accurate grinding to be accomplished in the shortest time possible. This is valuable equipment that will increase the earning capacity of a repair shop.

Manufactured by the Bean Company, First avenue, Berea, O. Descriptive literature, price list, etc., mailed on request.

MECO ENGINES.

The Meco engine is made to burn gasoline, kerosene and natural gas. It is a hopper cooled, governor controlled, centre firing, valve in head type. The ignition is similar to that system used in automobiles. A safety spark retarder affords easy and safe starting. All engines are guaranteed for durability, capacity and all around efficiency. Dealers, black-

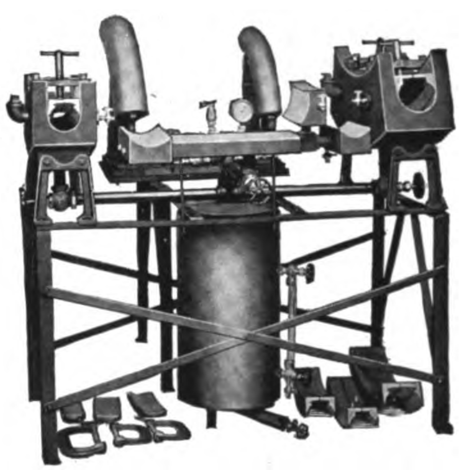


smiths and garage owners in small towns should have no trouble in disposing of these stationary engines to farmers, small manufacturers, etc. The dealer no-risk proposition is well worth investigating. Big discounts offered on a well advertised line.

Marketed by the Manufacturers Engine Company, 1899 Crystal avenue, Kansas City, Mo. The list prices range from $35.10 for a two-horse power engine to $210.90 for a 12-horsepower. Portable engines range from $40.15 to $248, and the engine saw rigs from $128.25 to $272.50.

VANDERPOOL VULCANIZERS.

The Vanderpool two-cavity combination vulcanizing outfit is equipped for repairing any portion of the outer casing, as well as tubes. Molds are fitted for the repairing of clincher or straight side shoes. Clamps, extra molds, etc., are



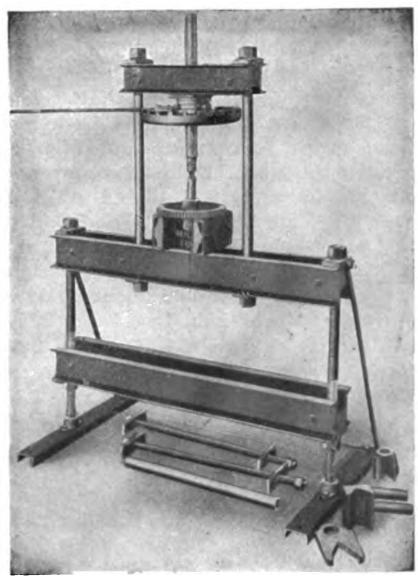
supplied with the outfit. Suspended from the top cross bars of the frame is a tubular boiler, 12 inches in diameter, which can be heated either by a gas or gasoline burner. The apparatus has very wide scope and affords opportunity for very satisfactory profits on repair jobs. The manufacturer is advertising in all parts of the country.

Marketed by the Vanderpool Company, Springfield, Mass. Catalogue and price list supplied to the trade upon request.

UNIVERSAL AUTO PRESS.

The Universal auto press is designed exclusively for garage work. It is of the screw type and affords a uniform and powerful pressure up to a maximum of 20 tons. The screw is made of the highest grade steel, is two inches in diameter, has a range of travel of 12 inches and does not revolve. The press is so designed that a rusted shaft requiring 50 or more tons pressure can be started. This is a feature of extreme importance in garage work.

As seen in the illustration, the apparatus is a combination of two presses. The upper unit has capacity of 16½ inches between the uprights and 16 inches under the screw. The lower table, or bolster, is for wide work and has capacity of 42 inches between the uprights.



A screw extension piece to reach the work uone on this table is supplied. It is possible to raise or lower the table to meet the requirements of the work. If the work is bulky the lower section may be taken off by removing the two bolts that hold it.

The Universal auto press is self-contained and stands upon the floor independent of any other support. It can be moved from place to place to meet the conditions. It is made of the best materials and is fool proof in every detail. The uprights are guaranteed to withstand four times the pressure capacity of the press.

The attachments include a V block that will instantly adjust itself to any size mandrel and bushing; channel blocking for bracing transmission gears, etc.; a V nose for use in straightening shafts and also in connection with the vise block for holding rear systems, awkward work or when cutting pipe; two pieces of shafting that are flattened and lay upon the

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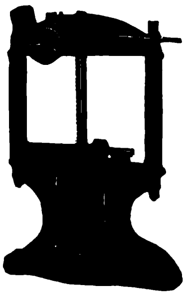
table for support to a shaft to be straightened; an extension piece, cupped to fit the screw, for reaching work on the lower table; and two tie rods that support the lower table when heavy pressing is to be done on the same. This is valuable equipment. Write for trade terms.

Manufactured by the United Engine and Manufacturing Company, Hanover, Penn. List price, $55. Detailed information and discounts supplied on request.

GREENERD ARBOR PRESS.

Having a pressure capacity of 10 tons with one man and 16 tons with two men, the Greenerd No. 15 arbor press is es-



pecially adapted to garage and repair shop work. It will easily accomplish such work as forcing off transmission gears, flywheels, drive shaft gears, straightening of axles, shafts, frames and other parts that require a high and steady pressure. The press is powerfully constructed and will stand unlimited service. Wide clearance space between the two uprights allows work being done on large wheels, pulleys, etc. This is exceedingly valuable equipment and will return large profits on jobs.

Marketed by Edwin E. Bartlett, 322 A street, Boston, Mass. Catalogue and prices supplied upon request.

PREST-O-LITER.

The Prest-O-Liter, consisting of insulated burner tips in the lamps and a small vibrator coil connected by simple wiring and operated by a single push button, will allow the driver to adjust the acetylene lights without leaving his seat. The necessary current is supplied from the ignition battery or from special dry cells. By the turn of a little valve and the press of a button, the lights are lit. They can be dimmed or extinguished as desired. Should the electrical system fail through loose connections, etc., the lights may be lit by a match in the or-

dinary manner. Backed by a comprehensive advertising.

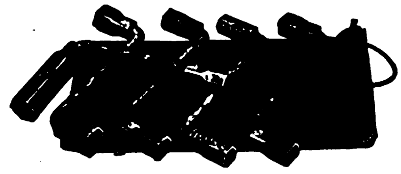
Manufactured by the Prest-O-Lite Company, Inc., Indianapolis, Ind., producer of dissolved acetylene and welding equipment. Full information concerning all products can be obtained on request.

MOSSBERG TOOLS.

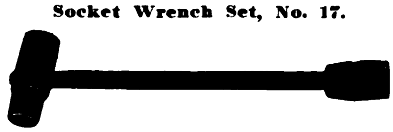
Among the many Mossberg wrenches and specialties are several sets of master tools, designed to meet all the requirements of the model "T" Ford car, which has many nuts and bolts that are inaccessible to ordinary wrenches. Wrench No. 645 is especially designed for the reverse and brake tension springs. The maker states that this tool will save at least 30 minutes over the ordinary methods in the adjustment of these components. The thin goose neck wrench, listed as No. 640, has a plain open end and is used on the reverse spring.

An engineers' set of wrenches, designated by the manufacturer as No. 10, consists of five thin wrenches, each of which has two openings of different

Engineers' Set, No. 10.

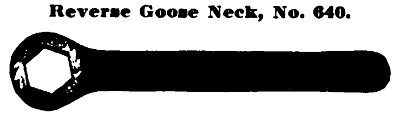


Socket Wrench Set, No. 17.



Cylinder Head Wrench, No. 630.

Reverse Goose Neck, No. 640.



Reverse and Brake Wrench, No. 645.

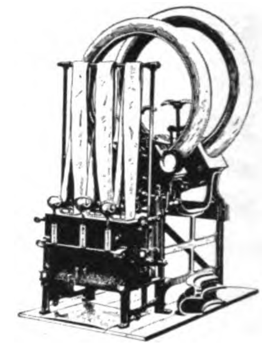
sizes. These tools are thoroughly hardened and neatly finished, and are sold in the case shown.

Another set valuable to the owner or repair man is the socket wrench set, No. 17. It consists of 10 sockets, with hexagon and square openings. These are adapted for use on the Ford 1915 model main bearings and nuts A spark plug wrench is included in the set, which is packed in a canvas case. The cylinder head nut wrench, No. 630, is another necessary tool.

Manufactured by the Frank Mossberg Company, Attleboro, Mass. Prices and trade discounts supplied to the trade upon request.

VULCANIZING OUTFIT.

The Akron-Williams No. 5 combination steam generating repair equipment is a complete vulcanizing plant, designed to meet the need of those who are prevented from installing a regular boiler by city or building regulations. This equipment consists of 4½ to five and 3½ to four-inch sections, a 2½ to three-inch re-



ducing shell, and an eight by 20-inch inner tube vulcanizer combined with a gas or gasoline heated steam generator of sufficient capacity to supply steam to both vulcanizers.

This apparatus will accommodate all makes and sizes of casings and tubes, ranging in size from 2½ to five inches inclusive. Each cavity has three separate steam chambers for the purpose of supplying heat to the repaired part only. This arrangement eliminates the danger of overcuring any part of the tire. Besides concentrating the heat only to the repair part, this feature also saves steam.

Manufactured by the Williams Foundry and Machine Company, Ash street, Akron, O. Detailed information concerning this and other equipment supplied on request.

TUTHILL SPRINGS.

Tuthill springs are designed to eliminate the possibility of breakage at the centre when the vehicle on which they are mounted is carrying even extraordinary loads. The design does not include the conventional bolt hole through the centre of the assembly, which arrangement not only makes for great strength, but increases elasticity. These springs are guaranteed against centre breakage, as well as against defects in material and in workmanship. The leaves are lubricated with graphite, which prevents squeaking and insures maximum resiliency. They are as nearly non-crystallizing as is possible, and have been subjected to exceedingly severe tests to determine this fact. The manufacturer has an interesting and valuable booklet, en-

titled, "Tuthills Best Sellers," which is being sent free of charge to inquirers.

Manufactured by the Tuthill Spring Company, 756 Polk street, Chicago, Ill. Prices upon request.

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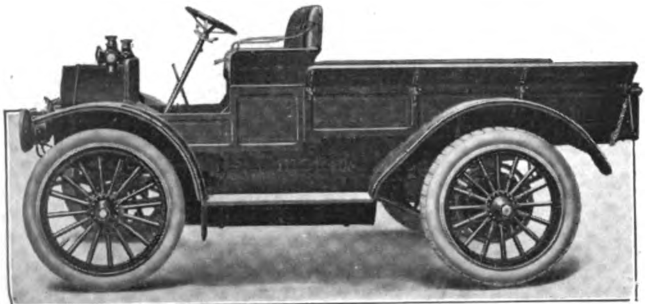

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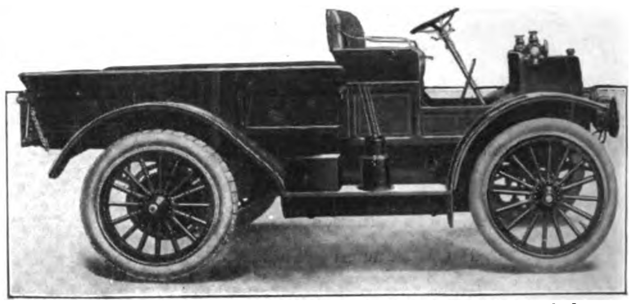

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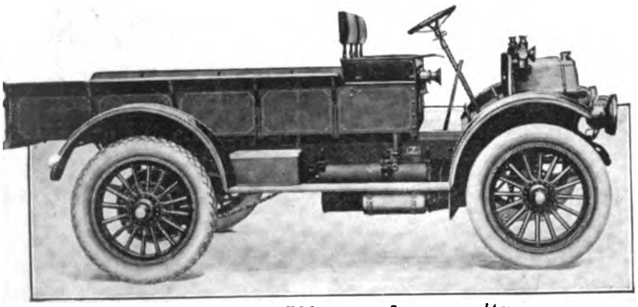

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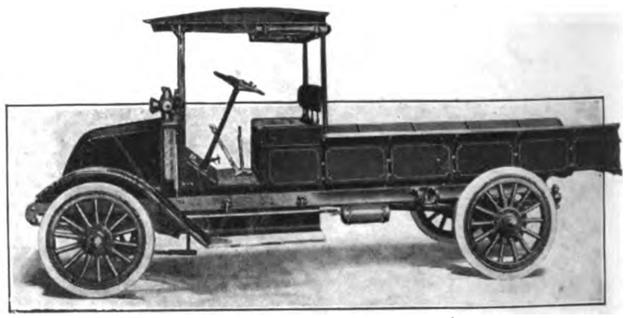

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